CEREAL SCIENCE today

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OF INTEREST THIS MONTH

PROTEINS AND NUTRITION

PHOSPHORUS IN FEED SUPPLEMENTS

COMMERCIAL DRYING OF RICE



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NEW EDITION

The Vital Story of MILLED WHITE RICE

Enriched with Vitamins and Iron for Better Health

by Science Writer

A second "Battle of Bataan" in the Philippines has proven beyond all doubt the value of vitamin enrichment to consumers of white rice.



The famous Bataan experiment in 1948-1950 proved conclusively that whole populations can benefit from enrichment of white rice with vitamins and iron, that disease and death caused by dietary deficiencies can be overcome, that enrichment is a key to better health among infants, children and adults.

What Happened at the Second "Battle of Bataan"

Before the start of the Bataan trial, these facts were evident:

- Polished white rice is the principal food of millions throughout the world. Good food though it is, it lacks several of the key nutrients occurring in the brown rice from which it is milled, and beriberi is often common where white rice is the main food.
- In the Philippines, beriberi was common and mortality from it high.



- Beriberi is caused by insufficient vitamin B_1 in the diet. It yields when vitamin B_1 is given to its victims. It does not occur when human beings receive enough of this vitamin in their diet.
- To prevent beriberi where white rice is the the main food, vitamin B_1 must be added to the diet, either by itself or in food such as rice.
- For centuries it has been universal practice to rinse rice before cooking, hence vitamin B_1 (and any other water-soluble nutrient factor) should be added in such a way that it will not dissolve out.
- Through a process developed in the laboratories of Hoffmann-La Roche, it is possible to enrich white rice with water-soluble vitamins and iron so they will not wash off during this rinsing prior to cooking.



With these facts known, the second "Battle of Bataan" began. Through the cooperation of Philippine public agencies, the Williams-Waterman Fund, the USPHS, and Hoffmann-La Roche a controlled experiment was set up in the province of Bataan. More than 12,000 medical examinations were made, before the enrichment of rice began. Nearly 13% of those examined had beriberi.

Enriched white rice was then put into commerce in the experimental area, but not in the control area.

What happened? *Within two years beriberi was practically wiped out in the experimental zone!* . . . beriberi mortality dropped almost to zero . . . almost 90% who had symptoms of the disease before enrichment's start were free from signs of the disease or were greatly improved . . . thousands of people were helped to better health. News of the success of enrichment reached people in the control area and caused them to demand that their rice be enriched, too.

Other Countries Follow Suit

Word of the excellent results of the Bataan experiment fanned out throughout the world. The largest rice miller in Thailand marketed enriched white rice with success in 1951. In that year, also, the Puerto Rican government enacted legislation requiring that all white rice sold there be enriched, beginning early in 1952. Since then, enriched rice has been made available to the public in Cuba, Venezuela, Colombia, The Dominican Republic, Taiwan (Formosa), Singapore, and Australia.



South Carolina Adopts Rice Enrichment

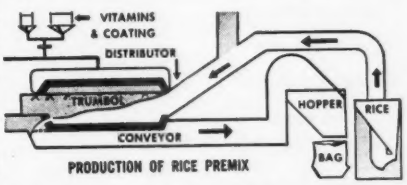
South Carolina, a state having very high per-capita white rice consumption, passed a law in the spring of 1956 requiring that all white rice sold within the state after July 1 be enriched with vitamin B_1 (thiamine), niacin, and iron, and it is hoped to include riboflavin (vitamin B_2) at a later date. South Carolina is the first state in the USA to enact rice enrichment legislation; it has required enrichment of white flour and corn meal since 1942 and 1943 respectively.



How is White Rice Enriched?

The enriching method in widest use throughout the world employs a method developed in the laboratories of Hoffmann-La Roche Inc., pioneers in the research and production of vitamins.

The Roche method impregnates rice grains with thiamine, niacin, riboflavin if desired, and iron and adds a final, outer coating of edible material to protect the vitamins against deterioration and preliminary washing and rinsing. For economy large amounts of vitamins are applied to small amounts of rice to make a "premix" and one pound of this "premix" is then mixed with a larger quantity (usually 199 lbs.) of ordinary milled white rice at the rice mill. As required in Philippine and Puerto Rican legislation, U. S. Federal Specification N-R-351C and South Carolina regulations for bulk (bags of 50 or more pounds) white rice, each pound of this nutritionally-improved rice provides not less than 2.0 mg. of thiamine, 16 mg. of niacin, and 13 mg. of iron and 85% of these levels are assuredly present after a prescribed rinsing test. In some countries, riboflavin also is included.



PRODUCTION OF RICE PREMIX

Other methods of enriching are permitted by the South Carolina statute. Small amounts of rice packaged for retail sale may have the vitamins and iron present as a powder which clings to the individual rice grains, or a liquid spray can be used. These packages must be labeled: "Do not rinse before or drain after cooking."

The Federal Food and Drug Administration in December of 1956 published proposed definitions and standards of identity for enriched rice. These standards, currently under discussion, provide for vitamin levels along the lines of Puerto Rican and South Carolina requirements.

What of the Future?

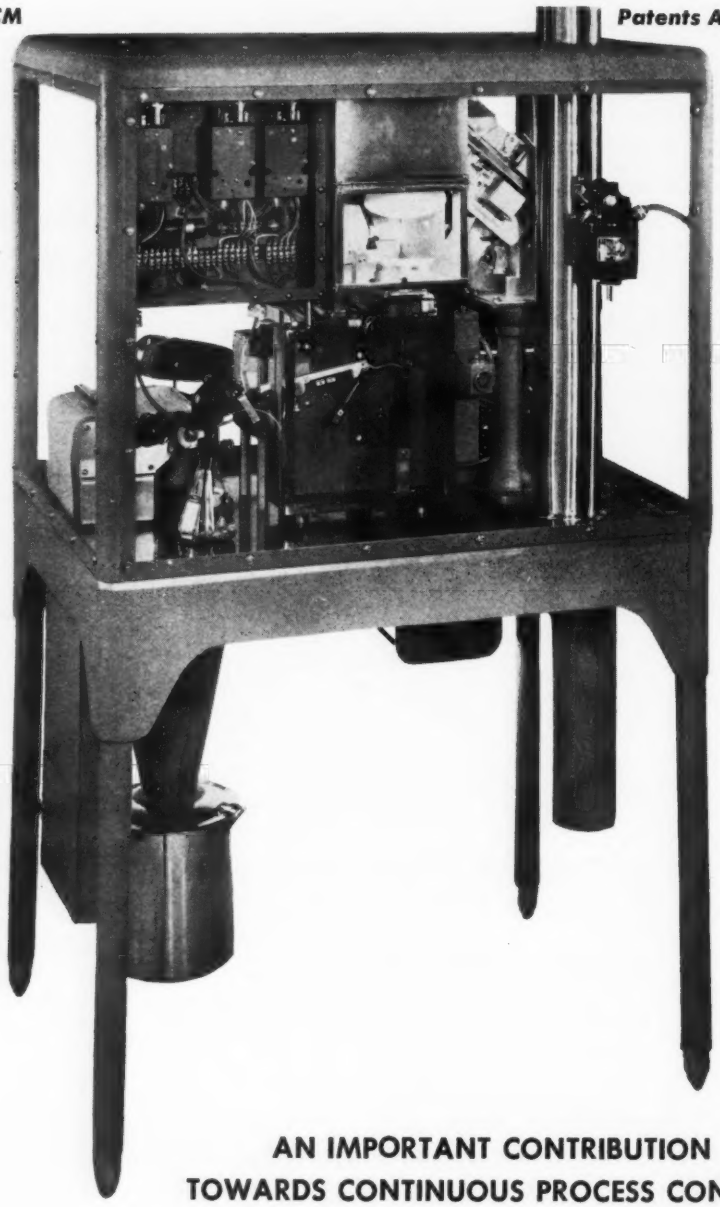
The trend to nutritionally-improved foods for better health is definite. The United States, a world-leader in the enrichment of white flour, white bread, corn meal and grits, farina, pastina, macaroni products, and breakfast cereals is now recognizing the need to enrich milled white rice. *When good foods are made better, everyone benefits.*

This article is part of series on the enrichment of processed cereal grain foods which are enriched for better nutrition. It is published by the Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. An illustrated brochure containing the text of all articles in the series is available at your request without charge.

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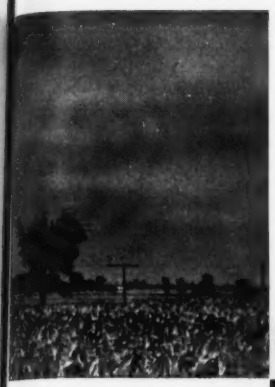
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COVER: Flour is held in large bins at Pillsbury's mill in Springfield, Illinois, prior to going to the packing floor below. (Photo courtesy Pillsbury Mills, Inc.)

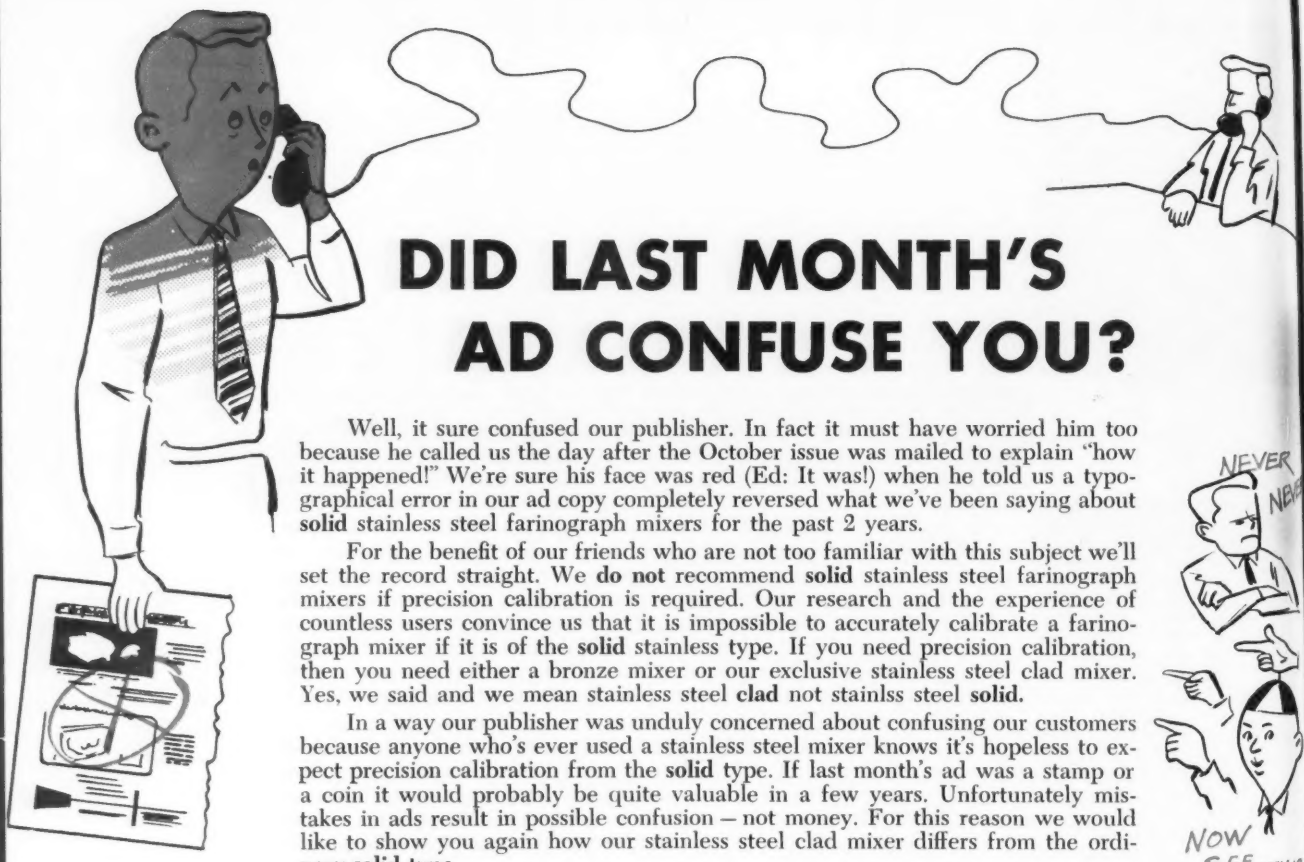
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DID LAST MONTH'S AD CONFUSE YOU?

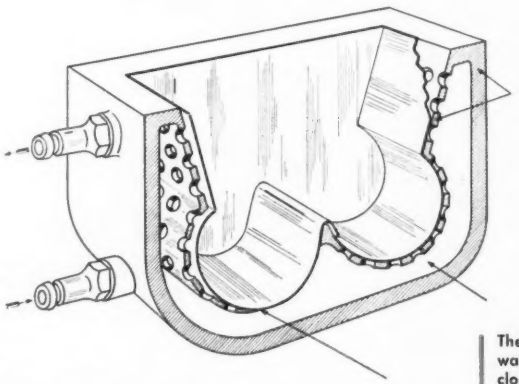
Well, it sure confused our publisher. In fact it must have worried him too because he called us the day after the October issue was mailed to explain "how it happened!" We're sure his face was red (Ed: It was!) when he told us a typographical error in our ad copy completely reversed what we've been saying about **solid** stainless steel farinograph mixers for the past 2 years.

For the benefit of our friends who are not too familiar with this subject we'll set the record straight. We **do not** recommend **solid** stainless steel farinograph mixers if precision calibration is required. Our research and the experience of countless users convince us that it is impossible to accurately calibrate a farinograph mixer if it is of the **solid** stainless type. If you need precision calibration, then you need either a bronze mixer or our exclusive stainless steel clad mixer. Yes, we said and we mean stainless steel **clad** not stainlss steel **solid.**

In a way our publisher was unduly concerned about confusing our customers because anyone who's ever used a stainless steel mixer knows it's hopeless to expect precision calibration from the **solid** type. If last month's ad was a stamp or a coin it would probably be quite valuable in a few years. Unfortunately mistakes in ads result in possible confusion – not money. For this reason we would like to show you again how our stainless steel clad mixer differs from the ordinary **solid** type.

As you can see from the cutaway drawing, our mixer is basically bronze (for good thermal conductivity) covered with a sheet of stainless steel only 0.3 mm. thick. The honeycombed design of the bronze casting allows ample contact between the stainless steel sheet and the thermostat water, insuring constant temperature control of the dough. Thus you get the advantages of both metals with none of their disadvantages.

It took five years of intensive research to develop this clad type mixer and we do not hesitate to compare its performance with the original bronze type. Of course, we'll be glad to sell you a solid stainless steel mixer if you want one, but don't expect to obtain precision calibration **regardless of of what was said here last month.** Our recommendations for mixers are: bronze or our exclusive stainless steel clad for use where precision calibration is necessary; solid stainless steel where accurate calibration is not required. And this is official!



Heavy bronze frame with high thermal conductivity.

Thermostat - circulated water is brought into close contact with the dough, being separated from it by only 0.3 mm. wall.

Stainless steel sheet, only 0.3 mm. thick. The lower thermal conductivity of the stainless steel is compensated for by the extreme thinness of the sheet.

No, we didn't shoot our publisher, at least not yet, although another goof and we might. It all goes to prove the importance of just one word – *clad, for precision!*

Sincerely yours

C. W. BRABENDER INSTRUMENTS, INC.
South Hackensack, New Jersey

P.S. If you find an error in this ad, please write me. Perhaps we can get rid of our publisher after all!



Editorial

PRICE AND PERFORMANCE together determine value. For buyer and seller to be on common ground when price is discussed, it is necessary to have a description of performance — a specification. A specification may be a purchaser's description of his requirements, a vendor's description of his standard product, or a mutually agreed-upon compromise between these. For many commodities the usual specification is a grade assigned by government inspectors in accordance with prescribed standards.

Any manufacturing operation can be described in terms of its raw materials and processing steps. Such descriptions are sometimes used as purchasing specifications. They have advantages. They are easily written, all products made according to directions are satisfactory, and no consideration need be given to the end use.

Cereal chemists are frequently concerned with specifications. Much of the laboratory work in industry is done to find out whether specifications are being met. Not so generally recognized is the role of the chemist in writing specifications, and the difference between good and bad specifications. Sometimes the specification tends to become an end in itself, rather than a means of assuring performance. When this happens, cost of the product is likely to be increased by the expense of conforming to and checking many requirements having no effect upon an intended use. Worst of all, the purchaser may not receive the quality he thought he was buying.

Writing a good specification requires up-to-date knowledge of the customer's needs, the best techniques for checking performance related to these needs, limitations of the supplier's process, and costs. In this age of rapid technological change and shifting economic patterns, even good specifications become obsolete unless reviewed and revised from time to time by well-qualified persons who can approach the task with open minds.

PAUL E. RAMSTAD

OUR CURRENT KNOWLEDGE ABOUT

Proteins and Nutrition

By John S. Andrews*

THE GREEKS HAD a word for it! Proteios, meaning "holding first place." Over one hundred years ago a Dutch chemist gave the name "Protein" to a group of nitrogen-containing compounds to emphasize the importance of the role they play in life. Mulder regarded proteins as universal components of plant and animal tissue and termed them as "unquestionably the most important of all substances in the organic kingdom." During the century which has passed, the progress of science has increasingly revealed the justification of this name.

No attempt will be made here to enumerate all the virtues of proteins. Their ramifications are too numerous! Women take advantage of the properties of the protein, keratin, to place curls in their hair, and bakers depend on the gluten in wheat to make light-textured loaves of white bread. Proteins impart to the whites of eggs the properties which enable the homemaker to make angel food cake and meringues. Casein in milk forms curds which are the basis of cheese. This same protein finds important uses in the coating of paper and in the production of adhesives.

They are vitally involved in cell growth and, in the guise of enzymes such as insulin, they control many of the processes of metabolism. They are an important part of the body mechanisms which build up immunity to disease, and combined with other substances in the blood they give to hemoglobin the properties which enable it to carry life-giving oxygen to the body tissues.

Such versatility points to the complex composition which proteins possess. As molecules, they are big. Common salt has a molecular weight of about sixty. In contrast, many of the so-called simple proteins have molecular weights of thirty to fifty thousand and those of more complex structure have molecular weights which run into the millions. It is little wonder, despite the extensive knowledge of modern science, that much remains to be known about proteins. Many books have been written on proteins, but almost without exception each contains admissions of our ignorance and points to the vast amount of research required before a complete understanding will be available.



As director of Food Research at General Mills, Dr. John Andrews oversees development of all the company's cereals and mixes, including the Institutional and Betty Crocker lines. Another department in his activity carries on an extensive research program on flour quality. Dr. Andrews has a bachelor of science degree from the University of Maine, an M.A. from Harvard, and a Ph.D. from Johns Hopkins.

Amino Acids

Fortunately, not all fields of research require such intimate knowledge. In some branches of science a simpler picture enables us to make progress. The field of nutrition is a good example. Someone has aptly stated that the nutrition of proteins is the nutrition of amino acids. Amino acids are the "building blocks" of proteins and are relatively simple. They have all been isolated as pure crystalline compounds and synthesized in the laboratory. They all contain carbon, hydrogen, oxygen and nitrogen (two of them also contain sulfur), and the way these atoms are linked together is pretty well known. Amino acids are obtained from proteins in a variety of ways. One of these is by subjecting them to the action of acids and enzymes such as takes place during digestion.

There are some twenty-two amino acids and all or practically all are found in every protein. Proteins differ by having different amounts and arrangements. When one considers the number of possible arrangements this presents, he wonders less at the complexity of proteins. Again in the field of nutrition we are fortunate in having a further simplification.

In order to grow, the human body must have protein. It needs it to build muscles, skin, hair, nails, the various organs, etc. Each of these is comprised of protein and in all instances the proteins are different. In order to build these proteins, the body needs amino acids. Nature has provided the growing cell with a mechanism which enables it to put together the various amino acids in the number and proportion required to make its specific protein. Just how this growing cell "knows" which protein it should make is nature's secret and promises to remain a secret for a long time to

* General Mills, Inc., Minneapolis. This article is reprinted with permission from Vol. 11, No. 2 of *Progress Thru Research*, a publication of the GMI Central Research Laboratories.

come. But the fact remains that muscle cells always produce muscle protein, and skin cells, skin protein, and never the reverse.

The source of these amino acids is food — food containing protein. In the digestive process food proteins are broken down into their amino acids which are then available for cell growth. When cell growth flourishes, we know that an adequate supply of amino acids is available.

Many years ago it was shown that not all foods are capable of producing optimum growth. Young rats, for example, grew poorly when supplied a diet in which the protein came solely from cereal grains. When milk was added, growth proceeded at a normal rate. For example, it was shown that the failure to grow on a diet in which wheat gluten was the sole source of protein was due to the absence of adequate amounts of one amino acid, lysine. This was one of the early experiments which established the importance of amino acids.

In modern times this type of experimental study has included all the amino acids. The results have been most interesting. Strangely enough, the animal body doesn't have to get all its amino acids directly from protein. Of the twenty-two amino acids which comprise proteins, the rat needs only ten. Human feeding tests show that the human is even less restricted. He needs only eight. The rest can be synthesized in the body, providing some simple source of nitrogen is available for the synthesis.

Just why the animal body can make some of its amino acids and not others is unknown. But from a nutritional standpoint, it is not too important. The knowledge that of all the amino acids found in the body proteins, only eight are essential in the food is the backbone of present-day protein nutrition. We can do a lot with this knowledge. The list of "essential" amino acids is: tryptophan, lysine, methionine, threonine, phenylalanine, leucine, isoleucine, and valine.

If we make sure that our diets contain sources of these amino acids in the required amounts, the protein aspects of our nutritional status will be satisfactory. A major problem of the nutritionist today is concerned with two questions: What are the required amounts? Where do we get them?

How Much Protein?

Early attempts to determine how much protein is required were made seventy-five years ago. Voit carried out a series of feeding tests which indicated that the average daily requirement was approximately one-quarter of a pound (118 g.). Some years later, this figure was challenged by several investigators. At the turn of the century a vegetarian named Fletcher promoted a new concept about eating. He believed that people did not chew their foods enough. Better health would result if one would practice the art of mastication more vigorously. He wrote a book which enumerated the numbers of "chews" each kind of food should be given. If after this amount of chewing the food was not swallowed voluntarily, it should be spit out. The social aspects of this procedure did not contribute to its popularity and "Fletcherizing" never caught on.

It did, however, have an influence on nutrition since among its several "virtues" was the claim that thorough mastication would reduce by two-thirds the amount of protein required to maintain good health. Forty-three grams, or about one and one-half ounces of protein was considered adequate in the daily diet. Other workers advocated similar low-protein diets, claiming that larger amounts were wasteful and tended to produce toxins. Gout was attributed to excessive dietary protein. These low-protein ideas, however, were not universally accepted. Other investigators surveyed the dietary practices of people all over the world and showed that the most progressive races were those which consumed substantially larger amounts of protein.

What Kind of Proteins?

These surveys also pointed to the superior value of protein foods derived from animals over those obtained from plants. Meat, eggs, milk, etc., supplied better protein nutrition than cereal grains alone. The reason for these differences between animal and vegetable proteins was sought.

One of the early demonstrations which explained this difference was the aforementioned studies of cereal protein. Young rats fed on gluten as their sole source of protein grew much more poorly than when fed on diets containing the same amount of milk protein. When, however, lysine was added to wheat or gluten, for example, their rates of growth substantially increased. It was obvious to conclude that rats require lysine and that the amount in gluten was considerably less than in milk.

When cereal grain and milk are combined, good growth takes place. This is an old story to the farmer who learned by experience that his calves thrived much better when he fed skim milk and grain than when he fed the grain alone. A mixture of animal and vegetable proteins produces good nutrition. This is reflected in our modern ideas about nutrition which establish that a good diet should derive at least half its protein from animal sources. The recommended daily dietary requirements of the National Research Council are based on this premise.

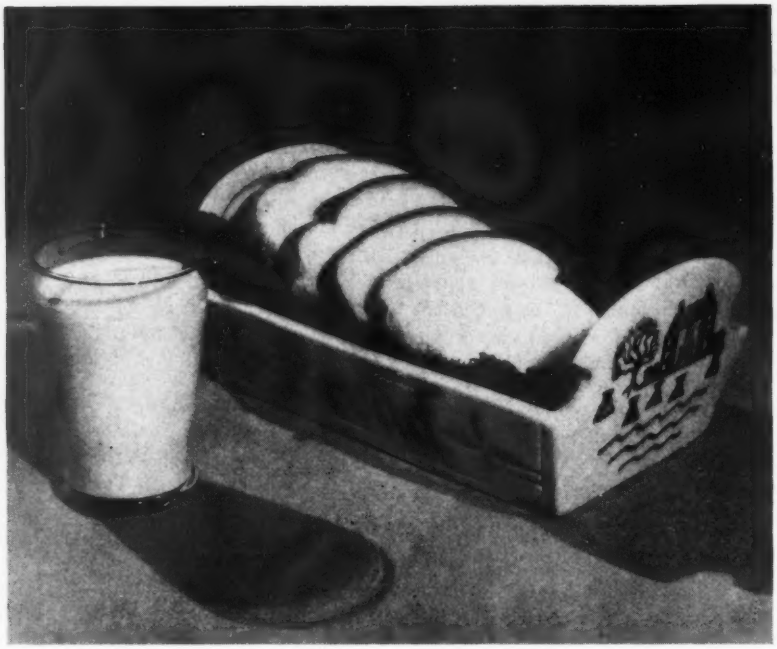
Gluten and Lysine Together

In this connection, another aspect of protein nutrition should be considered. If in the feeding tests on corn or wheat gluten and lysine the two are not mixed together but are fed separately several hours apart, the growth response is not as good. Apparently the processes of metabolism in the body require their simultaneous presence for most efficient utilization. This brings to mind one of the food fads which gained wide publicity thirty or more years ago — the Hay diet. Hay focused attention upon the different rates of digestion of different foods and advocated that proteins and carbohydrates should be eaten separately. To him a meat sandwich was the equivalent of a poison. All sorts of conflicts in the body took place when it was required to assimilate both proteins and carbohydrates at the same time. It was much better to consume the meat at one meal and the bread at another!

Fortunately, Hay's novel ideas were soon discredited, but not before a number of folks had practiced them rather extensively. The fact that bread contains significant amounts of protein did not deter some of Hay's more ardent followers. Today we know that the favorable combination of whole grains and milk also applies to bread and meat.

Nitrogen Balance

Recognition that protein nutrition is essentially the nutrition of amino acids has led to studies of the amount and kind of amino acids required.



Four slices of bread and one cup of milk, eaten together, provide 25% of the recommended daily dietary allowance of protein and 60% of the recommended intake of lysine.

Pure amino acids derived either from proteins or synthesized in the laboratory have been fed both to rats and to humans. Requirements have been measured by recording rat growth and by comparing the amounts of protein nitrogen fed with that excreted. When in adult humans and animals the amount of nitrogen excreted equals the amount consumed, the body is said to be in nitrogen balance and the amino acid requirements satisfied. By means of such studies it has been established that rats require ten amino acids and humans require the eight previously listed as essential.

A quantitative picture of these requirements has required some sacrifices on the part of the human subjects involved. The diets which must be rigorously followed are far from what most of us would regard as palatable. Over a period of days and even weeks each participant must give up his or her normal eating habits and pursue a particularly monotonous and unsavory dietary regimen. Almost all our common foods contain proteins and as such are on the "verboten" list. Meat, milk, eggs, bread, etc., are excluded for the duration of the tests. Any deviation by those being tested would lead to unreliable results. Not all could survive such temptations. To those who did, we owe our thanks.

These nitrogen-balance tests have given us some valuable results. They have established the amount of each of the essential amino acids which the adult human should consume each day to maintain normal health. This gives us an important guide as to how much protein we should eat (Table I).

Table I. Recommended Amino Acid Intakes for Adults

	g.
Tryptophan	0.5
Lysine	1.6
Methionine	2.2
Threonine	1.0
Phenylalanine	2.2
Leucine	2.2
Isoleucine	1.4
Valine	1.6

At this point we should perhaps indicate that these values have some very definite limitations. They do not include, for example, the much larger requirements for the growing child. Protein needed for building larger and larger muscles, skin, vital organs, etc., is not included. Nor do they include the protein required by expectant and nursing mothers. They merely represent the requirements to maintain growth, to repair worn-out tissue, to extend fingernails and to give jobs to barbers.

It seems reasonably safe to assume that the best nutritional combination of amino acids in the diet is represented by proteins with compositions closely resembling those of the protein in the body tissues. In a large sense this is true. The composition of meat, milk, and eggs, for example, is very similar to that of the body protein. We can carry this thought too far, however, if we apply this principle too specifically. Thus, the protein of hair is much lower in lysine and higher in cystine than the other body tissues. The fact that we eat meat to obtain good protein for building muscles does not imply that we should eat fur to build hair. The amount required for hair growth in the human is pretty small compared to other proteins. However, in the growing rat, hair is important and partly for this reason protein studies made on animals cannot always be applied too literally to humans.

Protein Research

The quantities of amino acids present in proteins have long been the subject of extensive research. As our knowledge of chemistry increased, new analytical methods were devised and applied to all sorts of proteins. However, the similarities between the chemical properties of the various amino acids made accurate differentiation difficult. Many values reported in the scientific literature were admittedly in error. Only in recent years have reasonably reliable values been obtained. Many of these were derived not from chemistry but from studies of the nutrition of microorganisms. Like man and other higher forms of animals, bacteria also require amino acids for growth. Unlike plants which can synthesize all their amino acids from the elements, some bacteria must have specific amino acids in their diets. The extent to which these bacteria grow depends on the amount of amino acids. Thus we have an analytical tool for measuring the amino acid composition of foods. Such methods are being applied today to supply data vitally important to the progress of protein nutrition.

Let's look at the amino acid composition of some common food proteins (Table II). Since our interest here is in terms of nutrition, only the essential amino acids are listed.

Several things will be noted. The total amount of these amino acids in the animal proteins (meat, milk, and eggs) is considerably greater than in the vegetable sources.

There is a further limitation. The nutritional value of proteins, like the

Table II. Essential Amino Acids in Some Common Foods
Grams in 100 g. of Protein

Amino Acid	*Meat*	*Milk*	*Eggs*	*Corn*	*Wheat*	*Rice*
Tryptophan	1.4	1.5	1.5	0.7	1.2	1.2
Lysine	10.0	8.7	7.0	2.7	2.7	3.4
Methionine[a]	4.4	4.2	6.4	3.4	4.3	2.9
Threonine	5.0	4.7	4.3	4.1	3.3	3.6
Phenylalanine	5.0	5.5	6.3	4.5	5.1	4.7
Leucine	8.0	11.0	9.2	12.7	7.0	8.4
Isoleucine	6.0	7.5	7.7	4.0	4.0	4.7
Valine	5.5	7.0	7.2	5.3	4.3	6.3
Total	45.3	50.1	49.6	37.4	31.9	35.2

[a] Includes cystine which can serve as part of the methionine requirement.

weak link in a chain, is limited by that essential amino acid which is present in the least-required amount. All six of these proteins are lowest in tryptophan. However, only 0.5 g. of this amino acid is needed in a good daily diet for adults. The next amino acid, lysine, is required in larger quantities, 1.6 g. daily (see Table I). This is 3.2 times the tryptophan. Since corn and wheat proteins contain less than 3.2 times as much lysine as they do of tryptophan, lysine is the more limiting amino acid in both of these grains.

If we take the values for tryptophan as equal to one, ratios for the other amino acids can be readily calculated. These ratios provide a convenient method for comparing the nutritive values of different proteins. Such patterns for the six foods are shown in Table III. The values given in parentheses are the ratios obtained similarly from the recommended dietary intakes in Table I.

Table III. Amino Acid Patterns

Amino Acid		*Meat*	*Milk*	*Eggs*	*Corn*	*Wheat*	*Rice*
Tryptophan	(1.0)	1.0	1.0	1.0	1.0	1.0	1.0
Lysine	(3.2)	7.1	5.8	4.7	3.8	2.2	2.8
Methionine	(4.4)	3.1	2.8	4.3	4.9	3.6	2.4
Threonine	(2.0)	3.6	3.1	2.9	5.9	2.7	3.0
Phenylalanine	(4.4)	3.6	3.7	4.2	6.4	4.2	3.9
Leucine	(4.4)	5.7	7.3	6.1	18.2	5.8	7.0
Isoleucine	(2.8)	4.3	5.0	5.1	5.7	3.3	3.9
Valine	(3.2)	3.9	4.7	4.8	7.6	3.6	5.3

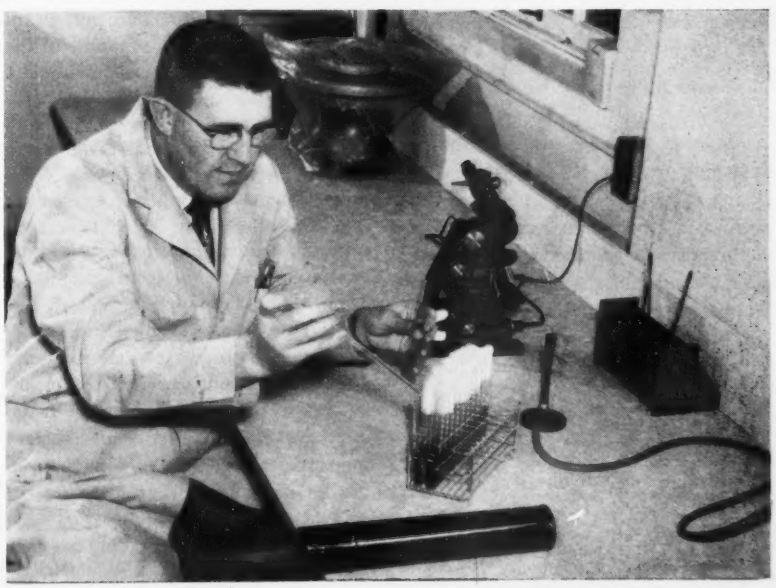
Comparison of these pattern values of meat, milk, eggs, corn, rice, and wheat reveals that the protein in eggs more closely equals or exceeds the values in parentheses for the recommended dietary intakes. This agrees with the findings of many feeding tests which show that eggs supply one of the most "perfect" proteins. Wheat protein is lowest in lysine, and milk in methionine. These are the limiting amino acids in these two foods. When wheat and milk are combined in a meal they help compensate for each other's deficiencies. This illustrates the value of mixed diets, particularly those which combine animal and vegetable proteins. While generally regarded primarily as an energy food, wheat supplies substantial amounts of protein and, combined with milk or meat or eggs, an excellent source.

Lysine as an Additive

In very recent years methods have been developed for making lysine available in commercial quantity. It can be isolated from various protein sources, or manufactured chemically or with microorganisms. This has introduced the possibility of overcoming the deficiencies of cereals by adding this amino acid just as in the case of vitamins and minerals. Whether or not such a step would be desirable is the subject of considerable controversy at the present time. Just what benefits would accrue to the consumer is difficult to assess in the light of our present knowledge. We know that the addition of lysine to the diets of animals in which the protein is derived solely from cereals produces better and more rapid growth. But, at least in the United States, the average person subsists on no such rigid regimen. Surveys reveal that the average diet in this country obtains more than half its protein from such foods as eggs, meat, poultry, fish, cheese, milk, and ice cream. Also the amount of protein consumed is fairly substantial. On the average, more than 90 g. of protein are present in the daily food supply.

In an attempt to determine just how much protein we should consume, the National Research Council called on the country's nutritional experts for their considered opinion. The result was a list of Recommended Daily Dietary Allowances believed to supply good nutrition to people of all ages. According to this list, adult men and women should eat 1 g. of protein for each kilogram of body weight. This amounts to 65 g. for a person weighing 143 lbs. Growing youngsters and nursing and expectant mothers should consume

(Please turn to page 264)



Dr. R. O. Wagenaar, section leader in General Mills' Food Development Department, assays protein for amino acid. He is adding test bacteria to tubes of a special broth containing protein of unknown lysine content.

PROGRESS IN BREEDING FOR BREAD

Wheat Quality In North America

By A. M. Schlehuber*

SOME OF THE major problems of breeding wheat for quality rest on the fact that different classes of wheat are produced in the North American continent. Over-all wheat improvement programs divide rather logically according to types of wheat and the region where each is grown. Quality must be considered in relation to the classes and their general uses.

"Probably the most difficult to measure of all characters that must be considered in a wheat breeding program is quality," according to B. B. Bayles (2). "Not only is it difficult to measure and interpret quality characteristics," he wrote in 1947, "but the tests are time-consuming and the equipment necessary for making them is expensive." While some important forward strides have been made in recent years, Bayles' statement is equally true today. It is well known that people who use the flour of hard wheats are not always in agreement as to quality.

Consideration will be given here only to the hard bread wheats—both winter and spring—because, first, of their importance in filling the needs of the chief importing countries, and second, because they constitute the major production in North America; wheat produced in the eleven Great Plains states constitutes 80% of the total hard red winter wheat and 43% of the total wheat in the United States (4). Third, space does not permit a discussion of all the classes.

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How the Two Hard Bread Wheat Regions were Founded

The story of Turkey (Kharkof) wheat, the first hard red winter wheat grown in North America, is well known. This variety was introduced by a small group of Mennonites who emigrated from southern Russia and settled in central Kansas in 1873. Because of its marked superiority over other wheats it spread rapidly and in 1910 it occupied about 99.5% of the hard red winter wheat acreage. New varieties have now largely replaced Turkey, but it was not until 1944 that Turkey was superseded as the leading variety in the United States. Its quality for the most part was satisfactory, and it is still being used today as a measuring stick for evaluating the quality of new strains.

Marquis wheat, after nearly 50 years following its release to the public, still stands out as the greatest achievement in wheat-breeding history. The international aspects that led to its development are important enough to bear repetition. One of the parents, Red Fife, was originally grown in Poland; thence it went to Germany, from Germany to Scotland, and from Scotland to Canada where it was used in the breeding of Marquis. From Canada Marquis came to the United States (3). It spread rapidly throughout both countries and was eventually tested in almost every wheat-growing area of the world. It has been called the "yardstick of quality" for milling and breadmaking purposes (1). Even today it is considered highly satisfactory for bread flour. While certain improvements admittedly have been made in the newer varieties of hard red spring wheat, Marquis quality is probably closer to that of the best hard red spring wheats than Turkey quality is to that of the best hard red winter wheats. In the opinion of S. C. Salmon,[1] for many years in charge of wheat investigations for the U. S. Department of Agriculture, "Probably it would be difficult to prove that the quality of hard red winter wheat as a whole is any better than when Turkey was about the only variety, but there is no reasonable doubt as to the improvement effected in the past ten to fifteen years by the great reduction in acreage of the poor-quality varieties."

Turkey Derivatives and Other Hard Red Winter Wheats

For brevity and some semblance of order, in discussing the quality of post-Turkey varieties of hard red winter wheat, the entire period of approximately 80 years from 1873 to 1957 may be divided into three general eras: pre-Tenmarq, 1873-1932; Tenmarq, 1932-1944; and post-Tenmarq, 1945-1957.

During the pre-Tenmarq era, in addition to Turkey, only two wheats of any real commercial importance were released, both in 1917. These were Kanred, a Turkey-type Kansas wheat, and Blackhull, said to be a selection from Turkey. Although rather large acreages of Kanred were grown for approximately 25 years, mainly in the 20's and 30's, it had little or no appreciable effect on the general quality level. It was Blackhull that created differences of opinion regarding hard red winter wheat quality. Blackhull probably was objected to more by millers than by bakers. In spite of its high test weight, it usually produced a lower percentage of straight flour than other varieties. Early Blackhull, a selection from Blackhull and released by a private breeder in 1930,

[1] Correspondence, Feb. 1, 1955.

achieved some commercial importance in the late 30's and early 40's. While this variety never was grown as widely as either Kanred or Blackhull, it caused more real problems, qualitywise, than both of those two varieties. Early Blackhull was not liked by the trade then and it is not today.

During the Tenmarq era Tenmarq wheat, which resulted from a cross of a Crimean (winter) × Marquis made in 1917 and released in 1932, carried the "quality load" for many years in the hard red winter wheat area. While it once held the position of leading variety of hard red winter wheat, it never had the wide-range adaptation of Turkey. Its good quality was "felt" particularly in the central and southern Plains states. There was considerable objection that Tenmarq was too "strong," and some wanted a weaker wheat; this was partly behind the reasoning for releasing some later wheats such as Pawnee and Comanche. But even in this area it met stiff competition. First objection came from the growers who were frequently disappointed in its low test weight, especially after a rain. Early Blackhull, a heavy test weight, early wheat of inferior quality, and ChiefKan, another high test weight wheat of inferior quality released in 1940, began making serious inroads on the good-quality varieties. While the total acreage of these two varieties probably never exceeded 12% (10), this was more than could be "carried" by the good-quality wheats, especially in those areas where the acreage of these two varieties was heavy. Cheyenne, released in 1933, and Nebred in 1938, both "strong," relatively long mixing-time wheats, have helped to uphold the quality; but these wheats are better adapted in areas unsuited agronomically for the production of the aforementioned inferior wheats. The release of Red Chief in 1940 by the same private breeder who produced ChiefKan was yet another setback qualitywise. The release and production of Early Blackhull, ChiefKan, and Red Chief probably had more effect on the reputation of the hard red winter wheat area than it did on real over-all quality.

The post-Tenmarq era brought about, partially as a result of this lowered reputation qualitywise, the production and release in 1943 and 1944 of a series of new wheats. These included Pawnee, Comanche, Wichita, and Westar.

Pawnee, released in 1943, has become the leading variety in the United States. In 1949 it was grown on over 11 million acres. However, by 1954 this acreage had dropped to less than 7 million (10). At the time it was approved for release Pawnee was the only variety available that could compete agronomically with ChiefKan. Briefly, ChiefKan had a grain texture considered too hard and produced a flour with a gray cast, extremely short mixing time, and very poor mixing tolerance; the flour produced a dough that was unstable during fermentation. In general, Pawnee met all the requirements of a good milling and baking wheat, except that its water absorption requirement was low and its mixing requirement was short. Its erratic behavior in the bakeshop has caused some concern and is generally attributed to its lack of tolerance to high temperatures during the fruiting period.

Comanche, also released in 1943, is superior in quality to Turkey and is approximately equal to Tenmarq except that it has a higher test weight. The qualities of this variety are generally well liked by the trade.

Wichita and Westar, released in 1944, were grown on more than 8 million acres in 1954 (10). These two will do little to either raise or lower the general quality level.

Ponca, released jointly by the Kansas and Oklahoma Stations in 1951, is a relatively strong, medium- to long-mixing-time wheat which should do much to bolster the quality in the less rigorous winter sections of the Pawnee area.

Concho was released by the Oklahoma Station in 1954. To judge by regional tests, it appears to have the widest range of adaptation of any hard red winter wheat released in recent years, with the possible exception of Pawnee. Its quality is good and it is regarded as a strong to moderately strong type.

Columbia, from a Rio-Rex × Nebred cross, was jointly released by the Oregon and Washington Stations in 1955 and now is also recommended by Idaho. It is a hard red winter wheat with satisfactory milling and baking properties.

Bison, a sister line of Kiowa (ChiefKan × Oro-Tenmarq), was released by the Kansas and Nebraska stations in 1956. Bison is agronomically very similar to Kiowa but has better quality. It has a mixing time equal to that of Comanche and Ponca. Loaf volume and other bread characteristics have been rated as excellent.

Crockett [(Sinvalocho-Wichita × Hope-Cheyenne) × Wichita, C.I. 12702], released from the Texas Station in 1956, has given consistently high yields in the southern part of the hard red winter wheat area. It produces high test weight grain of good quality.

Still newer wheats for release in 1957 include: 1) Itana (Blackhull-Rex × Cheyenne, C.I. 12933) by Montana and Idaho, a good-quality wheat to replace Wasatch; 2) Westmont (Rio-Rex × Nebred, C.I. 12930) for west of the divide in Montana and also a replacement for Wasatch; and 3) Rego (Yogo × Rescue, C.I. 13181), a sawfly-resistant winter wheat, for the western edge of the Montana triangle. Rego has better quality than Yogo but reportedly is somewhat lacking in winter hardiness.[2]

There has been renewed interest in wide crosses, especially with some of the Agropyrons. A number of these so-called Agrotricums (*Agropyron* × *Triticum*) have been produced, especially at the Oklahoma station, that are wheatlike, fair to good in yield and test weight, and have a highly resistant to immune reaction to leaf rust, but all are somewhat inferior in quality. A vigorous backcrossing program has been initiated in an attempt to correct these quality deficiencies (11). Everyone concerned is assured, according to a stated policy, that none of these strains will be released unless highly acceptable quality is indicated.

Quality of Marquis Derivatives and Other Hard Red Spring Wheats

It can be stated safely and without fear of contradiction that practically every important hard red spring wheat improvement program in North America has as its first objective the breeding of resistance to races of black stem rust, of which the most virulent has been race 15B. Consequently, progress in breeding for quality must be considered in relation to this major hazard. From someone on the outside of this area, perhaps the entire period can be arbitrarily divided into two eras: pre-15B and 15B.

[2] Correspondence, F. H. McNeal, March 13, 1957.

While it is recognized that this is a rough division, it must also be recognized that for many sections and all too many years in the hard red spring wheat area, unless wheats with rust resistance are grown, no one need worry about the quality of the crop! In the face of this major hazard, it stands as a real tribute and noteworthy achievement that there has been no loss of quality in any of the officially released wheats in either Canada or the United States. In fact, there is considerable evidence of progress in certain aspects of quality in the post-Marquis era. This has been realized because all research workers have been aware of the importance of high quality and, no less, because of the active interest and cooperation of the entire wheat industry in comprehensive quality tests before any wheat is released.

Salmon *et al.* (9), in an article entitled "A Half Century of Wheat Improvement in the United States," made a critical review of certain quality characteristics of Ceres, Thatcher, Pilot, Rival, and Mida compared with Marquis. They found the results in substantial agreement in indicating an equal or higher flour yield, protein content, and loaf volume for these varieties as compared with Marquis.

Glenn S. Smith,[3] Principal Plant Breeder in North Dakota, has stated that "Thatcher and Lee, which are now widely grown commercially, are stronger in mixing tolerance (and probably equal in most any other quality respect) than the older varieties Ceres and Marquis which they replaced." In the same communication he stated, "Most of the more recent varieties of hard red spring wheat would score rather high for quality in spite of the fact that Marquis was considered for many years to be superior."

Rescue, a solid-stemmed wheat resistant to the western wheat stem sawfly (*Cephus cinctus* Nort.), may be cited as one exception of a released modern wheat with somewhat inferior quality. R. F. Peterson,[4] Officer-in-Charge of the Cereal Breeding Laboratory, Winnipeg, Canada, stated that of the two sawfly-resistant wheats, Rescue is a little short on quality and Chinook has satisfactory quality. On the other hand, J. A. Anderson,[5] Chief Chemist of the Grain Research Laboratory for the Board of Grain Commissioners for Canada, has stated, "In my opinion, the outstanding bread wheat varieties recently bred in Canada are: Selkirk, which is resistant to race 15B of stem rust; Rescue and Chinook, which are resistant to sawfly, and Saunders, which is especially early. All of these wheats have good quality from the bread-making standpoint. The fact that Selkirk and Rescue are being used in the northern spring wheat area of the United States, and constitute the main defense in this area against the joint menaces of rust and sawfly, speaks well for the breeding program in this country."

Selkirk, a cross between (McMurachy-Exchange R.L. 2265) × Redman[3], is the only variety available to farmers which is resistant to race 15B. After the usual comprehensive quality tests in Canada, the United States, and in Britain, it was decided (in December, 1953) that it was equal to Marquis in quality. In this connection it should be mentioned that the Minnesota Experiment Station decided not to release Willet, a cross between Frontana and Thatcher with resistance to race 15B, because large-scale quality tests indicated inferior quality. This latter is a real tribute to the wheat research workers and attests to the splendid spirit of cooperation between industry and science. The Willet case parallels one in hard red winter wheat in the variety Cimarron, produced by the Oklahoma Station and ready for release in 1947. After extensive quality tests in 1948 in which industry cooperated, Cimarron was not released because of its inferior quality. Willet and Cimarron are outstanding examples of the importance attached to the production and release of high-quality wheats in the United States. This, I want to emphasize, is equally true in Canada.

The North Dakota Station released Conley, formerly designated ND 1, in 1956. This is a cross betwewen R.L. 2563 [Thatcher × (McMurachy-Exchange × Redman)[2]] × Lee[6]. It has an even higher degree of 15B resistance than Selkirk and is about equal to Lee in milling and baking characteristics. It is reported to be especially strong in mixing tolerance and in dough-handling properties. The very latest material at the North Dakota station involves crosses of Thatcher, Rushmore, Lee, and Mida with Kenya 338 for 15B resistance. It is reported that these crosses involve an even higher type of 15B resistance than either Selkirk or Conley. Of thirty derivatives tested by micro methods in 1954, at least twenty scored highly satisfactory for quality, displaying high protein, good flour yield, high absorption, satisfactory loaf volume, and medium to strong mixogram pattern. However, quality tests in the last two years were somewhat discouraging in that not so many lines had acceptable quality as earlier tests indicated. Smith[6] states, "Actually we have had considerable difficulty in recovering the strength of dough we wish. The few lines which have now shown satisfactory performance are consistently holding their position."

E. R. Ausemus[7] in Minnesota is using Kenya or Frontana in crosses for rust resistance and states that short mixing time is a serious problem when these wheats are used as parents.

The Canadians[8] gave no indications of new 15B-resistant wheats presently being considered for release. However, when we consider the comprehensive quality tests that Canadian wheats must undergo before they are licensed and released, we can be assured that if and when new ones are released they will uphold the Canadian reputation for producing high-quality hard red spring wheats.

Plant Breeding Techniques and Quality Testing

Numerous micro quality tests have been described for measuring many of the separate chemical and physical properties of hard wheat flour, but it is generally agreed that the macro methods are superior for evaluating varieties for quality (7). In my experiences in conferences between various disciplines of wheat improvement research in the past twenty-five years, the cereal chemist has been informed many times and in many different ways that while macro methods are satisfactory for certain evaluations, micro methods are the real need as a satisfactory aid in wheat breeding. Here let me come to

[3] Correspondence, Feb. 14, 1955.
[4] Correspondence, Feb. 25, 1955.
[5] Correspondence, Feb. 25, 1955.
[6] Glenn S. Smith, correspondence, March 28, 1957.
[7] Correspondence, March 17, 1957.
[8] A. B. Campbell, correspondence, April 18, 1957.

the defense of the cereal chemist. After certain micro methods were developed, the cereal chemist was told he must develop micro methods of the second order, i.e., "micro-micro methods." Finally he was told that he must develop micro methods that would allow the testing of the grain from individual plants and still leave a remnant for planting. It has even been stated, facetiously of course, that the ultimate is to develop methods for testing the quality of an individual seed and still leave a remnant for planting! Perhaps this is being unduly critical of the newer micro techniques. Some fine advances have been made using very small wheat samples (5 grams), but these, it appears to the author, have been more useful in evaluating milling quality than baking quality.

When we consider the complex nature of quality coupled with various definitions and criteria of quality, it appears we may not be ready for quality evaluations based on individual plants. There is a way, however, by a slight modification of the usual orthodox breeding procedures, to produce a fairly large quantity of seed from so-called F_2-derived lines. The method was proposed by Heyne and Finney (6) and consists of space-planting the seeds for the second generation so that each plant can be harvested individually. In the third generation an increase of each selected F_2 is obtained. Without making further selections, sufficient seed is produced in the F_4 generation to provide grain for milling and baking tests and these can be, if it is thought necessary, repeated in the F_5. Plant selections are made in the F_5 or F_6 generation of the F_2-derived lines that have superior physical, baking, and agronomic characters. Some experimental evidence is available to indicate that this method has merit. This modification, then, of the line or pedigree method may provide a procedure whereby macro methods can be utilized in determining the quality characteristics of new varieties.

In the Cereal Breeding Laboratory at Winnipeg, Canada, A. B. Campbell[9] writes: "We are planning to do more quality testing earlier in our breeding programs. Our feeling at present is that there has been too much emphasis on very small-scale quality tests using 5 to 10 grams of wheat, and that such tests are unnecessary. We are planning to do our first tests on F_4 lines, using about 100 grams of seed. We will forgo preliminary yield tests in favor of quality prediction tests." The Laboratory's cereal chemists are investigating a number of quality prediction tests that will fit in with the above scheme, and believe that the expansion test of Miller, Edgar, and Whiteside (8) offers the most promise at the present time. They are doing considerable quality work with all the parents that are being used in Canada. Fairly extensive knowledge of parental characteristics will enable them, they hope, to select the one or two prediction tests that will be of greatest value for each specific cross.

North Dakota workers[10] are using a modified backcross system with the good-quality wheats serving as the recurrent parent. In most cases the progeny are grown into F_3 or F_4 in order to secure desirable transgressive characters and then backcrossed or crossed to other derivatives which add to the recombination of desired characters. This pattern should lead to wheats which are satisfactory from the milling and baking standpoint and also offer new and superior recombinations of other desired characters.

With respect to specific quality tests, statements made by R. H. Harris,[11] Chairman of the Department of Cereal Technology at the North Dakota Station, are significant. He states that about 12 to 15 years ago flour yield probably was not thought especially important, and the emphasis was on testing flour by baking, judging the results chiefly on the basis of loaf volume and water absorption. In the last five years the emphasis has changed somewhat with the acquisition of physical dough-testing apparatus, added stressing by the baking industry of dough mixing requirements, and vigorous efforts of wheat breeders to develop varieties resistant to 15B. He states further that in view of these three factors much more reliance has been placed upon physical dough-testing data obtained with the use of the mixograph, farinograph, and extensograph.

Dr. Harris also stated that they have been impelled to give more attention to milling properties. Particle size distribution of some of the new 15B-resistant hybrids are markedly different from those of wheat they have been accustomed to testing, and approach the soft wheats in milling properties. Flours are softer and fluffier than normal for wheats grown in that region and they might very conceivably cause trouble in mills designed for hard wheats. "Since their flour volume is 30 to 40% greater than, say, Thatcher, the old standby for us, difficulty would be bound to occur in packing and transporting the flour to the bakery. We are discouraging the release of wheats which possess deficiencies in these milling qualities."[12]

Presently[13] North Dakota station researchers are working on a wheat-meal test which seems promising for preliminary information on flour milling attributes and possibly on physical dough characteristics. Fifty grams or less of wheat would be required. This method is based on that described by Harris and Bruner (5). They found a highly significant negative correlation between flour or meal volume and flour yield. Also, the use of whole-wheat mixograms for assessing mixing requirements in early generations is being further explored, but results to date have not been particularly promising.

At the Grain Research Laboratory, Winnipeg, J. A. Anderson[14] states that they continue to push their research on the development of methods for assessing quality, but work now in progress has not yet reached the stage at which they would claim any marked advances.

Wheat quality work at the Oklahoma Station is relatively new, but here too a search is under way for methods of assessing quality.

These examples should serve as ample testimony that research in wheat quality occupies a major portion of the over-all improvement programs of the bread wheats of the United States and Canada.

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(Please turn to page 264)

[9] See footnote 8.

[10] See footnote 6.

[11] Correspondence, Feb. 14, 1955.

[12] See footnote 11.

[13] Correspondence, March 12, 1957.

[14] Correspondence, March 18, 1957.



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COMMERCIAL DRYING OF WESTERN RICE[1]

T. WASSERMAN, R. E. FERREL, A. H. BROWN, and G. S. SMITH, Western Regional Research Laboratory,[2] Albany, California

CALIFORNIA IS THE only state in the West where rice is grown on a commercial scale. According to preliminary production reports, California became for the first time the leading rice-producing state in 1956. Production was 12,000,000 cwt., 25% of the nation's total. With the exception of a small fraction, rice grown in California is the short-grain or Japanese type, and is called California Pearl. Almost all is exported outside the continental limits of the United States.

Rice can be grown on dry land or under water. In this country it is grown in fields that are flooded with water during most of the growing season. This practice increases yields and serves to control competing weeds.

The rice industry in California is highly mechanized. Airplanes are used to spread seeds, herbicides, and pesticides; combines are used for havesting. During drying, transporting within the plant, and milling, the rice is handled in bulk by mechanical methods. Modern harvesting practices require that the entire crop be artificially dried, since combining does not permit field drying after cutting.

Rice belongs to a group of cereals, along with most varieties of oats and barley, which retain the hull after threshing. The threshed rice is called rough or paddy rice. The hull remains on the grain during drying and is removed as a step in the milling process. Rice is stored with the hull on, since it keeps better in that form.

Rice is generally harvested at a moisture content (wet basis) of about 20% and dried to approximately 13% for storage and milling. Commercial drying is performed in continuous-flow dryers similar to those used for other small grains. Grain is usually fed in at the top and flows through the dryer by gravity. Rate of discharge is mechanically regulated at the bottom. Drying is accomplished by forcing air, preheated by burning oil or gas directly in the air stream, through the grain as it flows downward. Various methods are used to direct the air through the rice, but in all of them air flow is essentially perpendicular to direction of rice flow.

Rice dryers can be divided into two types, mixing and nonmixing. The nonmixing columnar type (Fig. 1) is the simplest and the most commonly used. In this dryer rice descends between two parallel screens set 4 to 6 in. apart while heated air is blown through the screens and intervening rice. No appreciable mixing occurs, and the effect is similar to drying in a static bed with a depth equal to the distance between the screens.

Mixing types are of many designs, two of the most popular being the baffle design and the Louisiana State University design. In the baffle dryer (Fig. 2), rice is conducted downward in a zigzag path by means of baffles while heated air is forced through the grain. The

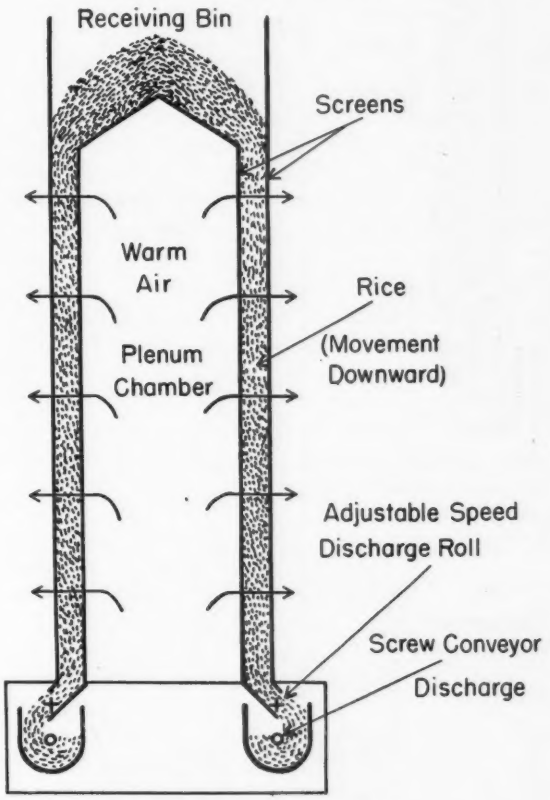


Fig. 1. Nonmixing columnar dryer.

Louisiana State University dryer (Fig. 3) consists of a bin in which layers of inverted-V-shaped air channels are installed. Alternating layers are air-inlet and air-exhaust channels. Each layer is offset so that the tops of the inverted "V's" split the streams of grain. Rice flows between channels and takes a tortuous path as it descends. Drying air passes from the air-inlet channels through the rice and out the air-exhaust channels. The amount of mixing that occurs in mixing-type dryers is unknown.

Unlike most cereals, rice is primarily consumed as unbroken grains or heads. In California, the number of pounds of unbroken grain that can be milled from 100 lb. of dried rough rice is known as the head yield. The

[1] Manuscript received June 17, 1957. Presented at the 42nd annual meeting, San Francisco, California, May 1957.

[2] Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture, Albany, California.

number of pounds of all milled rice (broken plus unbroken) from 100 lb. of dried rough rice is known as total yield. Both head and total yields are expressed in

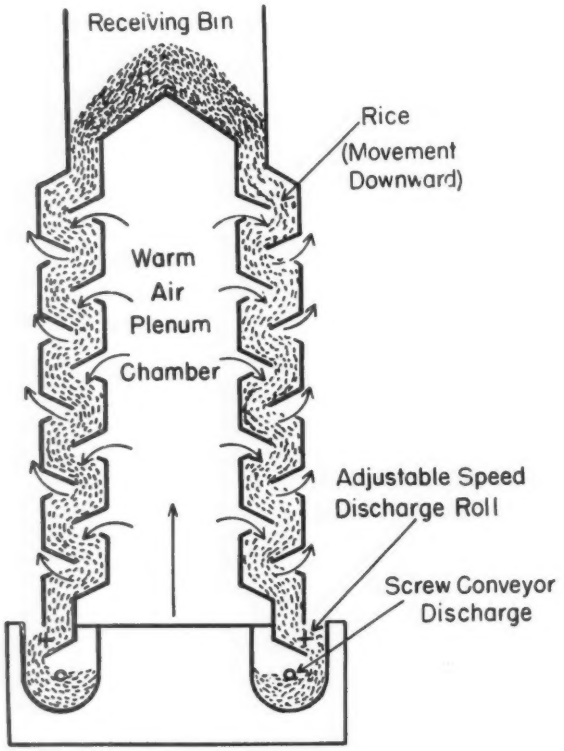


Fig. 2. Baffle-type mixing dryer.

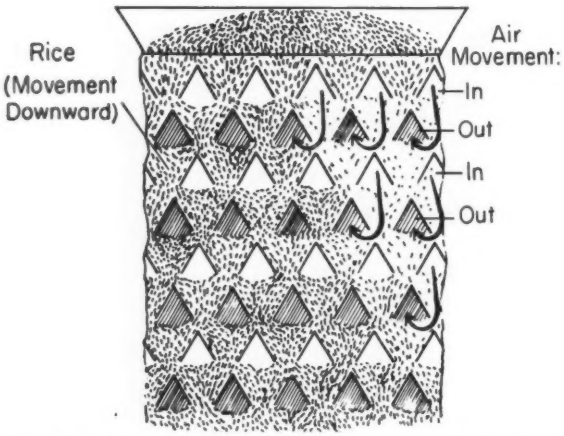


Fig. 3. Flow pattern in Louisiana State University (L.S.U.) type mixing dryer.

pounds or on a percentage basis. The market value of unbroken kernels is greater than for broken kernels. Thus it is important to avoid conditions that promote breakage. The care required introduces complications that are not encountered when most other grains are dried. The rice kernel is relatively fragile, compared to that of wheat or corn.

Drying rate of rice is largely controlled by rate of migration of moisture from the inside of the kernel to the outside. As drying proceeds the outer portion shrinks more rapidly than the more moist inner part, setting up stresses and strains. When too much moisture is removed at too fast a rate, checking or shattering of rice kernels results. To reduce this effect, rice is dried with air at 100° to 130°F. in two or more stages, with each stage involving a pass through the drier. Between drying passes the grain is held in a storage bin until the moisture equilibrates throughout the individual kernels. This step, called tempering, relieves stresses and strains and facilitates drying in the next pass.

Problems of the Dryer Operator

Drying conditions which give the highest head yield are not necessarily those which prove most practical at all times. Rice matures and is ready for harvest during a relatively short period, particularly in California. Adverse weather conditions during harvest have a pronounced effect on the selection of operating conditions. In damp weather the rice dries slowly in the field and is usually harvested at a high moisture content. Unless quickly dried, the grain is subject to rapid spoilage. Rice deliveries to the dryer are then more rapid than usual, and the drying-plant operator is called upon to dry the rice quickly. He must remove more moisture than usual under the handicap of high-humidity air. Hot and windy weather poses another problem in that the rice may dry too rapidly in the field and shatter. Growers speed up their harvesting to avoid this damage. The dryer operator must maintain a balance between rapid drying and turning out rice that will give the highest milling yields.

Guidance for the dryer operator, other than rule of thumb, has been very limited. The need for information on artificial drying of rough rice has been recognized and has resulted in a number of investigations, particularly at experiment stations in Arkansas, Louisiana, and Texas. Much of this work has been summarized (1). Varieties which predominate in the South (long- and medium-grain types) have been the subject of these investigations. Until recently, however, little specific information was available on drying characteristics of short-grain varieties grown under Western conditions. The Western operator has lacked information on the effects of drying-air temperature, velocity of air through the rice, humidity of the drying air, and number of passes through the dryer. Also, he has lacked information as to the minimum time required for tempering and time of harvest to obtain highest milling yields. In recent years studies have been undertaken at this Laboratory to provide information concerning these factors.

Laboratory-Scale Drying Studies

The object of these studies was to establish optimum conditions for commercial drying. Investigations were

directed to provide information in a form that might be used as a guide for the dryer operator, regardless of the type of dryer in his plant. Laboratory-scale studies showed how drying-air temperature and number of passes through the dryer affect head yield and total drying time. The relationship of these four factors can be represented on a single diagram to serve as an operating guide in the drying of rice. Figure 4, containing results obtained

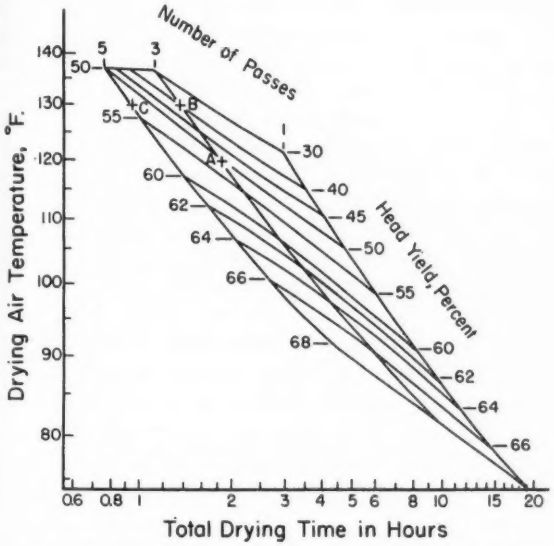


Fig. 4. Effects of drying air temperature and number of passes on head yield and total drying time.

when the Colusa 1600 variety was dried from 23.6 to 13.0% moisture, is such a diagram. It tells an operator what will happen if changes in drying procedure are made, and what methods of operation will bring greatest returns, depending upon whether plant capacity or high head yield is the factor of greatest importance under prevailing circumstances. The over-all trends indicated in Fig. 4 are basic for rice. However, numerical values will differ with variety of rice, season, type of dryer, depth of rice bed, amount of mixing in the dryer, air velocity as related to bed depth, initial moisture content of the rice, and other factors.

To illustrate the use of Fig. 4, assume that the operator ordinarily dries rice in three passes with air at 120°F. This method results in a 50% head yield and total drying time of 1.8 hours (point A). If the operator increased his air temperature to 130°F. with three passes, drying time would be reduced to 1.4 hours and head yield would decrease to 40% (point B). Thus plant capacity would be increased at the expense of head yield. If the plant is equipped with the necessary conveyors and tempering bins and the dryers are constructed to allow sufficient adjustment of rice through-put rate, considerable advantage would be gained by increasing the number of passes from three to five while changing air temperature to 130°F. The diagram indicates that for these conditions head yield would be increased to 54% and drying time decreased to 0.95 hour (point C). Compared to drying in three passes with 120°F. air, this would correspond to increases of 4% in head yield and 95% in plant capacity.

Laboratory-scale studies were also made to determine effects on drying time and head yield of humidity, air velocity, bed depth, and mixing of rice during drying. In addition, a study was made to determine the minimum time necessary to temper rice between passes. For reasons indicated later, shorter tempering times than those conventionally used in commercial plants would be advantageous. Four papers (2, 3, 4, 5) have been published on some of the results obtained in the laboratory-scale work. Papers on the remainder are in preparation.

Plant-Scale Drying Studies

Information from laboratory-scale studies was applied in two modern commercial plants equipped with dryers representing the two main types used in the industry. Results of these demonstrations showed that drying capacity of both plants could be greatly increased without loss in rice quality by increasing the number of passes and the air temperature. The improved procedures were adopted immediately by the plants.

It was also demonstrated on a commercial scale that rice can be adequately tempered in a much shorter time than normally allowed in plant operations. There was no difference in final head yield, viability, or subsequent drying rate as compared to conventional long tempering. Adoption of this finding will increase operating flexibility substantially, and can increase plant drying capacity severalfold in drying plants where over-all capacity is limited by storage space available for tempering. Papers covering results of this work are being prepared for publication.

Economic Considerations

Prices received for rough rice vary with milling yields and grade. Milling yields are expressed in terms of head yield and total yield, as described earlier. Grade is determined by characteristics such as color, odor, quantities of weed seed present, and insect damage. Grade will not be considered here other than to mention that grade level may be reduced if there is too great a delay between harvesting and drying or between stages of drying.

The importance of adjusting drying practices to obtain maximum feasible milling yields is apparent when the price structure of rice is examined. When the California grower sells rice, the price he receives is based on dried rough rice with a head yield of 48 lb. and total yield of 70 lb. A price differential is provided for rice that gives milling yields differing from these values. The differential amounts to 1 to 3 cents per lb. of head yield and 4 to 6 cents per lb. of total yield for each 100 lb. of rough rice. An average increase of only 1 lb. of head yield in California would increase the growers' annual returns on 12,000,000 cwt. (1956 production) by at least $120,000. Returns to the mills vary greatly with world market de-

mands for unbroken milled rice. If the 1-lb. increase in head yield were maintained through the milling process, annual returns to the mills based on the average of 1955 and 1956 prices would be augmented by approximately the same amount as for the growers. Information developed in the drying studies outlined earlier will assist the dryer operator in selecting drying conditions that will provide maximum returns for all concerned.

A second method of increasing head yields lies in harvesting at higher moisture contents. It is estimated that the average moisture content of rice delivered to dryers in California is 20 to 21%. However, in some instances rice is harvested at moisture contents below 15%. Data collected at a commercial drying plant indicated that several pounds of increase in head yield could be obtained by harvesting Western rice at moisture contents of 23 to 25%. The additional cost of drying at these higher moisture contents would be very small compared to the increase in returns that would result from higher head yields. Obviously, the dryer operator cannot produce a quality product from grain that has been damaged as a result of field drying. Harvesting at higher moisture contents is possible only if adequate drying capacity is available in the drying plants.

A point of interest to the dryer operator is that plant operating costs are reduced when dryer capacity is increased by increasing inlet air temperature and number of drying passes. In one commercial plant studied, operating costs were reduced by 1½ cents per cwt. of rice dried when plant capacity was increased by the method indicated here. This saving resulted from reductions in unit costs for fuel, power, and labor.

If commercial dryer operators use the studies summarized herein to approach optimum operating conditions closely, the annual earnings of the California rice industry might be increased by several million dollars without installation of additional dryers.

Summary

The main goal of the commercial rice dryer is to reduce the moisture content of the freshly harvested grain to safe storage levels with minimum feasible loss in rice quality. The minimum feasible loss depends upon permissible operating costs, characteristics of plant equipment, and urgency for rapid harvesting. Since the market value of rice is higher for unbroken than for broken kernels, drying operations must minimize breakage and cracking of the grain. The present report describes procedures used in commercial drying of Western-grown rice, outlines problems of the commercial dryer, and summarizes some of the results of laboratory-scale and plant-scale studies on rice drying conducted by this Laboratory. The drying studies were undertaken to provide data needed by the commercial dryer in adjusting his practices to meet varying situations.

Laboratory studies included determination of the effects of air temperature and number of drying stages on rice breakage and drying time. The results were summarized in a single diagram suitable for guiding rice dryer operators in selecting optimum drying conditions according to their need for additional drying capacity or higher product quality.

Plant-scale studies were conducted at two commercial plants equipped with dryers representing the main types used. Results of these tests showed that commercial practices can be improved through application of information developed in the laboratory studies. The economic gains that can be attained by the grower, dryer, and miller as a result of improvements are outlined.

Acknowledgment

The authors are indebted to Mrs. N. Floy Bracelin for drawing the illustrations.

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AVAILABILITY OF PHOSPHORUS IN FEED SUPPLEMENTS[1]

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THE SUPPLEMENTING OF feed for poultry and other animals has in past years followed a general theory: simply adding the nutrient in question at whatever level would meet the dietary requirement of the animal. That certain nutrients may occur in bound form or in a chemical form not readily available to the animal for metabolic utilization was scarcely considered, or not at all. The comparative availability of various phosphate supplements for use in poultry feeds is a case in point.

Maladies such as leg weakness in turkeys and fatigue in caged laying hens are mounting and appear to be associated with mineral metabolism. Hence, we need to deter-

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mine the adequacy of present-day mineral supplements in supplying the needs of the chick or poult. According to recent data, such products as colloidal clay, Curaçao rock, and certain rock phosphates are low in available phosphorus. Their use in feeds may, therefore, tend to decrease the animal's phosphorus supply appreciably, even to the extent of marginal deficiency. As feed control laws become more exacting in their requirements for guaranteed concentration of ingredients, problems of this nature are growing in importance to the manufacturer of commercial supplements and feeds.

Accurate and easily performed methods of determining availability must be devised. At present the standard method is that based on actual biological tests with animals. Growth and bone-ash analyses are the criteria for availability, where the supplement to be tested is compared to a reference standard having a high percentage availability. The materials, at varying suboptimal levels, are supplemented to a diet low in total or in available phosphorus. Assays take from 2 to 4 weeks, and calcification is determined at the end of that time by bone-ash analyses. Many studies using this method of testing various supplements have been reported, and the results point out the need for accurate specification of availability.

Poultry Studies

For growth and bone formation in the chick, Bird and Caskey (4) reported that amorphous calcium metaphosphate was equivalent to tricalcium phosphate. Analysis of the metaphosphate supplement for citrate-soluble phosphorus according to the A.O.A.C. method for fertilizer (3) showed that 96% of the total phosphorus was soluble in neutral ammonium citrate solution. Carver and Evans (5) found that defluorinated rock phosphate and superphosphate fines were only 79 and 90% as available as the phosphorus from steamed bone meal. Matterson *et al.* (15), using a diet much lower in phosphorus than that of Bird and Caskey (4), concluded that rock phosphate was just as available as tricalcium phosphate as a phosphorus source for the chick, while calcium metaphosphate was definitely inferior to the other supplements used.

Patrick *et al.* (18) tested samples of defluorinated rock phosphate, phosphate slag, tricalcium phosphate, and steamed bone meal for biological availability by chick and rat methods. Their data indicated that some preparations from slag and rock phosphates were nutritionally equal to steamed bone meal.

Gerry *et al.* (8) reported an extensive study on the availability of phosphorus from different sources, showing that raw rock phosphate was detrimental to the growth of young chickens. This was thought to be due to the fluorine content, even though Phillips *et al.* (19) found that growing chickens had a relatively high tolerance for fluorine.

In the studies of Gerry *et al.* (8) as little as 1.0% of rock phosphate, supplying a dietary fluorine level of 0.038%, definitely depressed growth during the first 8 weeks. These workers concluded that even though any one of the supplements used might have had ample phosphorus, the most desirable ones appeared to be steamed bone meal, treated rock phosphate, and melted rock phosphate. They also reported later (9) that raw rock phosphate in laying rations did not affect egg shell quality or the health of chicks produced from the eggs.

The comparative availability of a number of phosphorus supplements and pure phosphate compounds has been studied by Gillis *et al.* (10) by adding the phosphorus sources singly to a basal diet low in phorphorus. The ortho-phosphates, including potassium dihydrogen phosphate, pure beta-tricalcium phosphate, and reagent grades of mono-, di-, and tricalcium phosphate, were excellent sources of phosphorus which was slightly more available than that in steamed bone meal. A chemical test based on the solubility of the different products in 0.4% hydrochloric acid proved to be of no value in estimating the biological availability of phosphorus in various supplements.

These same workers (11) demonstrated that the phosphorus of phytin is not readily available to the chick regardless of the vitamin D content of the diet. Similar results were obtained by Sieburth *et al.* (20) using calcium phytate. They found that the phosphorus in this compound, as well as that in aluminum phosphate, was relatively unavailable.

In 1953, Miller and Joukovsky (16) reported extensive studies in which several phosphate supplements were compared as to effect on weight, bone ash, and mortality of chicks at 5 weeks of age. The authors fed dicalcium phosphate, Curaçao Island phosphate, bone meal, and defluorinated rock phosphate at two different levels, and concluded that all were good sources of readily available inorganic phosphate. The phosphorus in colloidal phosphate appeared to have only 50% of the availability of that in the other supplements.

Phosphatic clay (soft phosphate with colloidal clay) was also found to be a poor source of phosphorus for the chick by Grau and Zweigert (13). The phosphorus in this supplement was not as effective for growth or calcification as that in bone meal or tricalcium phosphate when fed to chicks in a diet composed of natural ingredients.

Gillis *et al.* (12) described a new procedure which appears to be quite acceptable for standardization of the activity of phosphorus supplements. A reference compound, beta-tricalcium phosphate, is given an arbitrary value of 100% availability. The test supplements are compared to this standard by supplementing both reference and test material at varying levels to a diet very low in phosphorus. These diets are fed to chicks for 4 weeks and the availability of phosphorus is then determined by the standard bone-ash method for calcification. All test supplements are assigned a value which is interpolated from the results obtained with the standard.

Gillis and co-workers tested and evaluated by this method a wide variety of phosphorus supplements currently being used in feed formulations. They found phosphorus highly available in mono- and dicalcium phosphate and in sodium and potassium acid phosphates. Most of the bone products had 90% of the availability of the standard, or better, with only one sample of steamed bone meal, bone char, a foreign bone meal, and bone ash fall-

ing below this level. All feed-grade dicalcium phosphates and defluorinated rock phosphates were considered to be good sources of available phosphorus, with one exception.

The raw rock phosphates, including Curaçao Island phosphate and colloidal phosphate, the pyrophosphates, and metaphosphates were rated very low in phosphorus availability; in some of these products it was too low for the supplements to be rated by this method.

There was wide variation among all the supplements tested, with values ranging from 0 to 113. This variation was evident within groups of supplements, although not to such a great extent.

Wilcox *et al.* (22) reported a wide range of variability from feeding different phosphate supplements, in the performance of turkey poults. Dicalcium phosphate, monocalcium phosphate, and two samples of rock phosphate were considered to be excellent. Two other samples of rock phosphate and all samples of colloidal phosphate contained relatively unavailable phosphorus under the conditions of the test. Steamed bone meal, one sample of rock phosphate, beta-tricalcium phosphate, commercial dicalcium phosphates, and tricalcium phosphate were intermediate with regard to the availability of phosphorus.

Needed: A Feasible Method

Although most of the previous work is in agreement on the relative availability of some of the supplements presently used, it is apparent that there is still a need for a simple, accurate method which can be carried out routinely. The present procedures are expensive as well as time-consuming, and not readily applicable in the average feed control laboratory.

Scott[2] has developed a method, using the chick, which greatly decreases the time required for the determination. The birds are given a phosphorus-deficient diet for a depletion period of 4 days, followed by a repletion period of 6 days using the deficient diet supplemented with graded levels of standard sodium phosphate, dibasic, and the test sample. Results have indicated bone meal and dicalcium phosphate to be excellent sources of phosphorus for the chick, whereas other products had a decidedly lower level of availability.

Derse[3] has reported that *Leuconostoc arabinosus* can be used as a test organism for microbiological determination of the availability of phosphorus from different sources. Preliminary results from this method agree quite well with those obtained with animals and the rumen microorganism technique of Anderson *et al.* (2).

Studies with Ruminants

The problem of phosphorus availability is not limited to poultry alone. When cattle are given a variety of feeds including legume hays, cereal grains, protein and salt supplements, there is little chance of a phosphorus deficiency. Grains and other concentrates are generally good sources of phosphorus. However, the great majority of cattle in the United States must subsist on pasture and native vegetation, seldom receiving grain or concentrates except during the winter months or during drought periods.

Lack of phosphorus is one of the major nutritional deficiencies of the beef-producing regions of this country. Low phosphorus in the soil means low phosphorus content as well as poor yields of forage grasses. This can be of extreme importance and demands supplementation of phosphorus in a readily available form, particularly since low phosphorus intake in cattle is directly related to poor calf crops and stunted calves, poor growth, lameness, fragile bones, poor appetite, and death.

The need of supplementary phosphorus for ruminants emphasizes the importance of a method of determining availability of this mineral. Davis *et al.* (7) fed labeled radioactive deflourinated phosphate to young cattle and determined phosphorus balance and tissue distribution of the active material. Through this labeling technique a direct measure was obtained as to the availability of phosphorus from this source in comparison with that of potassium dihydrogen phosphate. A parallel experiment with rats was run simultaneously. The phosphorus of defluorinated phosphate was just as available to calves as was that of the standard potassium dihydrogen phosphate. Results of studies on tissue distribution and balance indicated that approximately 70% of the phosphorus from deflourinated phosphate was absorbed and utilized by the animals.

Ammerman *et al.* (1) used a balance technique and fed yearling steers to evaluate various inorganic phosphates. Supplements tested were two dicalcium phosphates, bone meal, defluorinated rock phosphate, imported rock phosphate, and colloidal phosphate. Approximately one-half of the total phosphorus was supplied by the test supplement and the remainder by the basal ration. Balance calculations were made on the basis of a 21-day preliminary feeding period followed by a 7-day collection period. Blood-plasma phosphorus levels were determined following each collection. No differences were noted in plasma phosphorus or in the supplements tested.

Long *et al.* (14) studied the comparative value of the phosphorus from colloidal clay and dicalcium phosphate for cattle when each was fed at a level below that required for optimum growth. Three groups of heifers were used; one group was fed the basal phosphorus-deficient ration containing 0.09% phosphorus, and the other two received the basal ration supplemented with colloidal clay and dicalcium phosphate at levels such as to supply an additional 0.05% phosphorus. Differences in responses between colloidal clay and dicalcium phosphate at the end of 98 days were significant and favored the latter. Heifers fed dicalcium phosphate were normal, but those fed colloidal clay had anorexia, were coprophagous, and had difficulty in walking. The ration supplemented with colloidal clay contained 65 p.p.m. of fluorine and it is possible that these differences may have been due to fluorine toxicity, since Mitchell and Edman (17) have stated that 100 p.p.m. of fluorine is a borderline amount for toxicity in cattle.

[2] Scott, H. M. Data presented before the Research Committee, National Mineral Feeds Assoc., Chicago, Ill., Sept. 21, 1955.
[3] Derse, P. Data presented before the Research Committee, National Mineral Feeds Assoc., Chicago, Ill., Sept. 21, 1955.

In a second series of experiments, Tillman (21) compared domestic steamed bone meal and Curaçao Island phosphate to dicalcium phosphate as supplements for cattle and sheep. All these supplements were found to be satisfactory.

Recently an *in vitro* fermentation with rumen microorganisms was developed by Anderson *et al.* (2) to measure phosphorus availability in cattle and sheep given phosphorus supplements. Cellulose digestion in a series of fermentation tubes was related to graded amounts of phosphorus added at the beginning of a 24-hour fermentation period. Among the supplements tested it was found that a composite sample of dicalcium phosphate was as available as a standard sodium-potassium phosphate mixture. An acidulated phosphorus product and steamed bone meal were intermediate in availability; Curaçao rock phosphate and colloidal clay appeared to be less available.

While many reports have appeared concerning the need of adding inorganic phosphate to swine rations, there are few data on the comparative availability of the phosphorus in these supplements. A recent report by Chapman *et al.* (6) indicated that rate of grain, feed efficiency, and breaking strength of femurs decreased markedly when colloidal phosphate was fed, as compared to steamed bone meal or dicalcium phosphate. These results were confirmed by Catron,[4] who demonstrated that different phosphorus supplements in the diet of the baby pig result in marked differences in bone ash, growth rate, bone strength, and feed efficiency. When compared to monocalcium phosphate as a standard, dicalcium phosphate and bone meal were about equal with regard to availability of phosphorus, while other sources tested were decidedly lower.

Summary

It is evident from the above review of published information on the availability of phosphorus that, in general, dicalcium phosphate and defluorinated rock phosphate are satisfactory sources of phosphorus for use in feeds for poultry and livestock. In raw rock phosphates mined from different areas, the phosphorus may be available in some samples and not in others.

The level of fluorine in phosphorus supplements is an important factor in the final determination of the value of a particular supplement as a source of phosphorus. According to many workers, the avian species is much more tolerant to fluorine than are ruminants.

A definite need exists for a routine, accurate method for determining the availability of phosphorus in any supplement intended for use in feed formulations. The method must be usable by state feed control laboratories, and should not be complicated by a long test-feeding period. The chicken and the turkey are two experimental subjects which appear to be usable for studies on the availability of phosphorus. Data from such studies could be used as a measure of the availability of phosphorus in a poultry feed supplement. However, studies carried out with the chick and poult may not be entirely applicable to supplements which are to be used in ruminant feed formulations, because the ruminant animal is more sensitive to fluorine toxicity. From the viewpoint of a method to determine availability of phosphorus in a supplement, usable for all species for which feeds are formulated, the problem is far from being solved.

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People, Products, Patter

. . . People

Robert W. Bond named manager of sales service department, Corn Products Sales Co.; formerly manager of technical sales at the company's Argo, Ill., plant. He will head a group of specialists who assist industrial customers in the application of company products to their operations.

Robert Branch joins laboratory staff of Crown-Centennial Flour Mills, Portland, Ore.

Clinton L. Brooke represented the AACC at a testimonial dinner on October 7 in Washington, D.C., honoring **Lewis G. Graeves'** 50th year as a baker. Mr. Graeves, president of Charles Schneider Baking Co. (Washington), has contributed significantly in such capacities as chairman, American Bakers Assoc.; president three terms, Potomac States Bakers Assoc.; member executive committee, Quality Bakers of America.

Alexander J. Carsky becomes assistant to vp and manager of food manufacturing, Beech-Nut Lifesavers Inc., Canajoharie, N.Y.

James F. Hale, technical director of Borden research center of Borden Food Products Co., elected chairman of the board of the Research and Development Associates, Food & Container Institute.

Richard M. Lawrence named research project analyst of A. E. Staley Mfg. Co., Decatur, Ill.

William D. McFarlane, Director of research, Canadian Breweries, Ltd., Toronto, Ontario, elected president of American Society of Brewing Chemists.

Thomas J. Schoch, co-editor of Starch and Starch Products Department, This Journal, will give four talks during a visit to the West Coast, reporting on some results of recent research in starch, especially as it pertains to food applications. He will address a joint IFT and AACC meeting in Los Angeles, Nov. 12, and a similar meeting in



San Francisco, Nov. 14. Other talks are at Oregon State College, Corvallis, Nov. 15; and a meeting of bakery engineers at Spokane, Nov. 20. Dr. Schoch is widely recognized as one of the world's leading starch chemists. He is in charge of starch research at Corn Products Refining Co.'s laboratories, Argo, Ill.

. . . Products

The advantages of employing butylated hydroxy toluene as an antioxidant for storage stability and vitamin retention in farm feeds, and for use in such human foods as are subject to oxidation, are described in Bulletin C-7-243, "Koppers HHT Antioxidant." Available on request from Chemical Division, Koppers Co., Inc., 1450 Koppers Bldg., Pittsburgh 19, Pa.

• • •

A booklet on the use of the Tote System of bulk materials handling is available to industry: request Catalog No. 6. It describes automatic filling and discharging stations; inter- and intra-plant applications of aluminum Tote Bins and Tote Tilts. Specifications on construction are given. A list of users and materials handled is included. (Tote System, Inc., Beatrice, Nebraska.)

• • •

New in flavorings and seasonings are two products by Dodge & Olcott, Inc. "Cocoa-van," a chocolate-vanilla flavor in powdered form, was developed to fill a need for better flavor in synthetic chocolate coatings. A proportion of 1% is said to be sufficient to add full, authentic chocolate flavor. In 100-lb. containers Cocoa-van is $1.75 per lb.; 25 lbs., $1.90; 5-lb., $2.00. A trial 1-lb. order at the 5-lb. price is currently offered (address below).

"Flavotang" is a flavor intensifier for use in processed meats, frozen foods, hamburgers, steaks, stews, soups, gravies, and the like. It comes in several forms containing varying amounts of monosodium glutamate (MSG), a blend of spice extractives (usually celery or celery and onion) on a carrier, either dextrose or salt, or both. Level of use ranges around 6 to 12 oz. in 100 lb. of finished product. Three forms based upon low-, medium-, and high-range MSG are priced from $0.50 to $1.04 per lb. in 200-lb. lots. Trial quantities available: Dodge & Olcott, Inc., 180 Varick St., New York 14, N. Y.

• • •

Recently introduced is the Marion Laboratory Mixer, designed for use in the laboratory or as a production machine, featuring cross-blending mixing action. Inside dimensions: 24 in. long, 12 in. wide, 16 in. deep; over-all length 36 in., width 19 in., and height, with legs, 34 in. Capacity 2 cu. ft. or approximately 50 lb. Available in either mild steel or stainless steel; equipped with a ¾ h.p., 1P, gearhead motor, angle-iron legs, and sponge rubber-gasketed cover. Specifications are available from Rapids Machinery Co., Marion, Iowa.

• • •

A sodium-based, nonnutritive sweetener offered by the Du Pont Company, "Cylan" sodium cyclamate (companion product to "Cylan" calcium cyclamate), is intended for use in formulations containing ingredients which would not be compatible with calcium; e.g., in recipes with phosphates, tartrates, and oxalates, where calcium would form insoluble salts. Both materials are white solids, practically odorless, and dissolve rapidly in water. Both provide about the same level of sweetness – 30 times that of sugar.

Products using calcium cyclamate, already on the market or being tried, include liquid and tablet sweeteners; canned and frozen fruits, juices; jams, jellies; gelatins, puddings, frozen desserts; salad dressings, pickles, catsup; syrups, bottled beverages. Technical assist-

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Vitamin Wafers
for Bakery Products and Macaroni
Vitamin A Acetate
Vitamin A Palmitate



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ance in fitting either product into food and beverage production is available from Du Pont. Write Product Information Service, Public Relations Dept., E. I. du Pont de Nemours & Co., Wilmington 98, Delaware.

. . . Patter

The U. S. Department of Agriculture has just issued a new edition of the Official Grain Standards of the United States, which includes the changed standards for wheat which became effective June 15 last. This publication supersedes all previous similar publications. Copies of the new handbook can be obtained from grain inspection offices of the Department of Agriculture, and should be in the hands of all mill grain departments.

• • •

A possible means of preventing virus infections in plants was announced by scientists from the Army Chemical Corps Biological Warfare Laboratories, at the AIBS meeting at Stanford University in August.

Initial laboratory experiments with greenhouse plants indicate that extracts from rice plants will inhibit growth of some plant viruses. Field trials necessary for conclusive evidence have not been made, however.

• • •

For years food chemists have relied principally on two accelerated tests to determine the oxidation stability of fats and oils and foods containing these ingredients – the Active Oxygen Method (AOM) for fats or oils alone, and the Schaal Oven Test for finished foods. Most technicians recognize the inherent errors in both of these methods and have taken them into account when evaluating the result.

Eastman Chemical Products, Inc., has developed a new, accelerated test based on a modification of the standard ASTM Oxygen Bomb Method by which gasoline stabilities are compared. Basically the method involves placing the fat, oil, or finished food under 50 or 100 lb/sq. in. of oxygen, raising the temperature to 212°F., and recording the time until pressure drops significantly. The test is carried out in a glass liner contained in a chromium-nickel alloy steel bomb which is then immersed in a boiling-water bath. The combination of pure oxygen, high pressure, and elevated temperature accelerates the oxidative deterioration of the material being tested. The end-point of the test is arbitrarily set as the mid-point of the first hour in which pressure drops at least 2 lb/sq. in. and which is followed by an equal or greater drop during the succeeding hour.

Statistical analyses of the AOM, Schaal, and Oxygen Bomb methods show the latter to be much more precise than either of the others. Further advantages are speed, particularly in comparison to the Schaal test, and less attention required by the technician during the test period. For details of the new method write Eastman Chemical Products, Inc., Kingsport, Tenn.

• • •

Celebrating the 75th anniversary of the Ohio Agricultural Experiment Station at Wooster, a symposium was held on October 14–16, on "The metabolic role of trace elements in plants, animals, and microorganisms." Fourteen of the world's leading authorities on trace elements brought together a digest of knowledge accumulated on the function of minor elements since the spotlight was directed on them a decade or more ago. The Kettering Foundation at Yellow Springs, Ohio, assisted in staging the conference.

Beginning with the general role of trace minerals in plants, animals, and lower life, the discussion moved to problems concerning specific elements including manganese, selenium, cobalt, boron, iodine, molybdenum, vanadium, copper, zinc, and iron.

Andre Pirson of the Botanical Institute, University of Marburg in West Germany, spoke on the part manganese plays in the well-being of living things. In the northwestern grain-growing countries of Ohio, a chlorosis capable of reducing yields has developed in soybean fields; scientists have traced its cause to manganese deficiency.

E. J. Underwood, staff member of the University of Western Australia at Nedlands and author of the latest book on minor elements, discussed the importance of trace elements to animals.

American authorities appearing on the program included Daniel I. Arnon, Univ. of California; S. H. Hutner, Haskins Laboratories, New York City; A. L. Moxon, Ohio Agr. Exp. Station; K. C. Beeson, Agr. Research Service, USDA, Ithaca, N.Y.; G. K. Davis, Univ. of Florida; John Skok, Argonne National Laboratories near Chicago; Samuel Kirkwood, Univ. of Minnesota; Alvin Nason, McCollum-Pratt Institute, Baltimore; and H. R. Mahler, Indiana University.

C. A. Elvehjem, chairman of the biochemistry department and dean of the graduate school, University of Wisconsin, summarized the trace element reports. Banquet speaker was C. F. Kettering; his topic, "Research and the future."

• • •

In July, General Foods Corporation began moving personnel and equipment from Central Laboratories at Hoboken, N.J., to its new research center at Tarrytown, N.Y. Nearly 500 scientists, engineers, and other technical personnel are being settled in.

New products and processes will be studied in the Development Building of the new center; chemical research and technological exploration will be the function of the Science Building. General offices, library, cafeteria, medical and other units are to be housed in the Administration building.

The program calls for intensified and expanded research in developing new products and determining basic food composition; in nutrition, food-flavor studies, continuous improvement of existing packaged food products, better packaging methods, etc.

EMPLOYMENT NOTICES

CEREAL CHEMIST

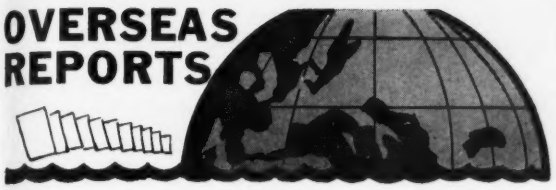
An excellent opportunity is available in our Research Department for a cereal chemist with baking experience. Research includes processing, product quality and product applications studies on wheat gluten and starch. Product applications work includes laboratory research and some technical service to bakeries.

REPLY TO: D. K. Dubois, Chief Chemist, Huron Milling Div., Hercules Powder Co., Harbor Beach, Michigan.

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OVERSEAS REPORTS



• • • **England**

A Conference on the Control of Chemical Additives in Food was held jointly by the U. S. Food Law Institute, the Food Group of the Society of Chemical Industry, the Society for Analytical Chemistry, and the Association of Public Analysts, at the Royal Institution, London, on July 26, 1957.

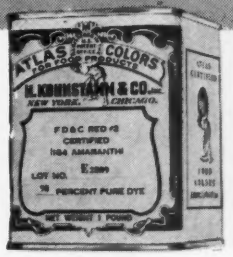
A paper by G. P. Larrick and L. J. Lehman (U. S. Food & Drug) described recent revisions in the existing Food, Drug, and Cosmetic Act prohibiting the use of any new additive unless adequate tests have shown it to be harmless when fed in large quantities for long periods, or have determined the levels which can produce no effect; such tests must be made known to, and found acceptable by, the Government.

It was emphasized that no simple or rigid procedure can be designed for pharmacological testing of additives; moreover, a generous safety factor is necessary to cover differences between the human race and animal species.

The Canadian position was described by C. A. Morell, Director, Canadian Food and Drug Directorate. While the government policy is to avoid unnecessary interference with private enterprise, questions frequently are asked about the safety of chemical additives. Although some government research is unavoidable, it should be the duty of industry to provide the evidence. Only adequately tested additives should be used, and tolerances for all chemicals should be set. Administrators must be guided by their own experts and when experts disagree, reference might be made to the United Nations' Food-Agriculture or World Health organizations. Substances used primarily to deceive the consumer are unacceptable.

British procedure was dealt with by Norman Wright, Chief Scientific Adviser (Food), Ministry of Agriculture, Fisheries, and Food. While local authorities are empowered to enforce general rules, he said, some supplementation of these rules is needed in dealing with complex medical and technical issues. Accordingly, Ministers may make regulations governing specific practices. In doing so they are guided by the Food Standards Committee, appointed by them and containing members nominated by the Medical Research Council, the Association of Public Anaysts, and the food industries, in addition to members appointed on a personal basis and officials of Government departments. This committee's terms of reference also cover food standards in general and the labeling of foods. A subcommittee has reviewed regulations dealing with antioxidants, coloring matters, and emulsifying agents, and is now engaged on preservatives. Its report on antioxidants has been published and regulations permitting a limited use of specified substances are being prepared. New regulations, including a permitted test, for coloring matters have recently been made. The use of coloring matters is prohibited where

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they may deceive the consumer. Specifications of the purity of the colors used are to be established.

Under the committee's procedure, all interested parties are invited to submit evidence on substances they wish to use, and evidence is collected on technical and medical aspects. Results of work carried out in other countries are considered. The summarized evidence, with specific recommendations from the subcommittee, is published, after which further representations by interested parties are carefully considered. After final Ministerial decision, proposals for regulations may be made public before submission to Parliament. Although this procedure is slow, it ensures that everyone has a reasonable opportunity to state his views. Dr. Wright stated that the Geneva Conference on Food Additives sought to secure the formulation of general principles and methods suitable for biological testing of additives. Two expert committees were appointed, the report of one of which has been published.

E. J. Miller (Plant Pathology Laboratory, Ministry of Agriculture, Fisheries, and Food) told of a British interdepartmental advisory committee to watch for hazards arising from the use of protective chemicals in agriculture. It is assisted by a subcommittee including technical experts, with panels set up to study particular groups of substances such as organic mercurials or antibiotics. On receipt of a request from a manufacturer for permission to use a certain chemical, information including data on toxicity residues and methods of estimation is studied by the subcommittee. Any recommendations from this body, after passing through the appropriate channels, are given requisite publicity; those intended to safeguard the consumer are implemented through voluntary cooperation of manufacturers, who provide appropriate instructions in advertisements and on labels, and in the trade press. Such cooperation appears to work well, Dr. Miller said. The use of certain fumigants, however, is subject to regulations administered by the Home Office.

H. Welch (Director, Antibiotics Division, U. S. Food & Drug) discussed the use of antibiotics as preservatives. While low-level antibiotics in animal feedstuffs leave no residues in the edible parts of the carcass and therefore present no hazard to the consumer, their use has provoked argument, he said. Two antibiotics may now be used in preserving uncooked poultry, in amounts limited to those known to be totally destroyed during the subsequent cooking. Proof of harmlessness of antibiotics when used on meat and fish is not yet considered complete.

In Canada, according to a paper by Morell and Thatcher, it must first be made clear that no hazard to the therapeutic value of antibiotics can result from their use for other purposes; it must then be shown that their use gives advantage to the consumer and does not cover fraud.

A. L. Bacharach pointed out several anomalies in the present legal position on antibiotics in the United Kingdom. The hazard of unwittingly encouraging undesirable organisms is common to all preservative measures, he said, but in pasteurization it is negligible. No harm has yet been found from traces of penicillin or other antibiotic occasionally present in bulk milk supplies.

C. R. Jones
Corresponding Editor

the President's Corner



news of the association

The attendance at the Tri-Section Meeting in Manhattan attests to the sincere interest of cereal chemists in their profession. Held on a Friday evening and Saturday morning (October 11th and 12th) members, primarily from Kansas, Missouri and Nebraska, gave freely of their leisure time to attend this regional meeting. The program ranging from a report on the infra red spectra of gluten from flours of varying baking qualities, through the rheology of doughs to the proverbial straight dough vs. sponge dough test baking, offered something of interest to everyone.

At the section officer's meeting in San Francisco, your Board of Directors offered CEREAL SCIENCE TODAY to the non-national members of the local sections at a reduced cost provided *each* non-national member of a section availed himself of the opportunity and the local section acted as the collecting agency. At its October meeting, the Midwest Section voted to subscribe to CEREAL SCIENCE TODAY for each of its non-national members. Cost for this year will be borne by the section. Next year cost will be defrayed by adjustment of non-national members' dues.

It is hoped this action by the Midwest Section may set a precedent that will be followed by the other sections. Some tie between the sections and the national organization is urgently needed.

AACC TECHNICAL COMMITTEES, 1957-58

Bran in Flour

Wilbur L. Deatherage, *Chairman;* R. E. Brown, M. A. Barmore, Richard R. Gartner, R. H. Harris, H. K. Heizer, T. H. McCormick, Byron S. Miller

Cake Flour

D. B. Pratt, *Chairman;* Harry Miller, Harry Loving, J. P. Woolcott, L. V. Rogers, Marvin Lawrenson, M. A. Barmore, L. F. Jents, Jason Miller, H. H. Favor, L. H. Fratzke

Cookie Flour

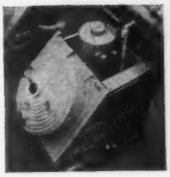
L. J. Brenneis, *Chairman;* L. H. Fratzke, Harry Miller, James C. Finley, R. K. Durham, Frank R. Schwain, Tod J. Stewart, Howard Simmons

Cracker Flour

Jan Micka, *Chairman;* W. H. Hanson, Marvin Lawrenson, L. S. Thompson, A. G. O. Whiteside, W. L. Heald, T. E. Hollingshead, Millo Prochazka, Ray Mooi

(Please turn to page 265)

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(molecular)



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LOCAL SECTIONS

Niagara Frontier Section members and families were guests on a tour of the Great Western Winery at Hammondsport, N. Y., on September 28.

The Section met on October 14 at Erie County Technical Institute, Buffalo. After-dinner speaker was Lyle Mertz, national president of the Association of Operative Millers; his subject, "Modern developments in the milling industry." The paper was prepared in cooperation with equipment manufacturers for presentation to the conference on milling and wheat utilization, Northern Utilization Research and Development Division, Peoria, Ill.

• • • •

Intermountain Section held its first meeting of the 1957–58 season on October 3. After dinner at the Mansion House in Ogden, Utah, the members adjourned to Pillsbury Mills for a look at the enlarged and newly equipped laboratory. An informal discussion of the new crop of wheat, led by Glen Blanch, followed.

• • • •

Additions to last month's report of the Nebraska Section's meeting on September 28: R. M. Sandstedt discussed "Further studies on starch granule structure." Panel members with moderator Howard Becker, discussing the quality of 1957 hard winter wheat, were H. H. Johnson, E. J. Rosse, L. Schonlau, and E. H. Lathrop.

Midwest Section met on October 7 at the Builders Club, Chicago, for cocktails and dinner. William B. Bradley, AACC President and Scientific Director of the American Institute of Baking, brought members up to date on Association affairs. Most of his speaking time, however, was devoted to the subject of "Bread — for man or rats." He discussed not only the role of bread in the mixed diet, as consumed in the United States, but also the differences in nutritional requirements of the human and the experimental animal used to evaluate "nutritionally superior" breads.

• • • •

The Northwest Section held their regular monthly meeting on October 25 at the Jax Cafe, Minneapolis. Guest speaker was Dr. John E. Barkley, Director of Physical and Chemical Research, General Mills Mechanical Division. Dr. Barkley discussed the Sky Hook project and Cosmic Rays.

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The Canadian Prairie Section has announced the resignation of one of its officers, Mr. Sam Kuhl, Secretary. Mr. Kuhl has taken a position with the North Dakota State Mill in Grand Forks.

On Tuesday, October 15, the section heard from W.O.S. Meredith who spoke on "Research on malting barley in Europe." Dr. Meredith recently returned from an extended visit to the malting laboratories of Europe and discussed his impressions with the section.

Just prior to the meeting, section members attended an open house at the new laboratory of B. Guy Hunt & Co. Mr. E. A. Higham of that company extended the invitation.

Nutrition:

(Continued from page 245)

more, up to 100 g. daily. These values assume that substantial amounts of the protein will come from animal sources.

In terms of amino acids, 90 g. of dietary protein in the average daily food supply are estimated to contain 5 g. of lysine. This greatly exceeds the 1.6 g. recommended from adult feeding studies. Undoubtedly not all of this amount is available, since some losses may occur in food preparation. If we assume that such losses may be as high as 25%, the daily diet would still contain 3.75 g. It would appear that from a total dietary standpoint a deficiency of lysine is unlikely in a good, average diet. However, diets abnormally low in protein or extremely high in cereals, such as exist in other parts of the world, present quite a different situation.

The protein picture can be illustrated very simply by examining an old standby — bread and milk. Four slices of bread supply 7.5 g. of protein containing 0.2 g. of lysine. One cup of milk supplies 8.6 g. of protein containing 0.75 g. of lysine. Together these bring to the diet 25% of the recommended daily dietary allowance of protein and 60% of the recommended intake of lysine. To those who are calorie-conscious, this dish of bread and milk furnishes 410 calories or only 16% of the average 2500-calorie diet.

As we continue to gain information such as this, it's certain we are moving toward a better and better standard of nutrition.

Today's homemaker enjoys modern methods of food preservation and a high per-capita purchasing power that enable her to choose her foods from a wider range than ever before. This range of choice, along with increased knowledge of nutritional values, is slowly but surely raising our entire national dietary to higher and higher standards.

Wheat Quality:

(Continued from page 249)

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President's Corner:

(Continued from page 263)

Farinograph Standardization
Max Milner, *Chairman;* I. Hlynka, Robert Laster, Stephen J. Loska, James Pence, W. C. Shuey, Lawrence Locker

Feed and Feedstuff Analysis
Max Cooley, *Chairman*
Subcommittee chairmen:
Mineral Analysis: Edward E. Chapman
Drugs, Antibiotics, and Hormones: Robert C. Wornick
Vitamin Analysis: E. F. Budde
Approximate Analysis: L. E. Schonlau

Flour Specification and Approved Methods
George Garnatz, *Chairman;* F. D. Schmalz, Betty Sullivan, John Whinery, Gaston Dalby, W. H. Cathcart, William Ziemke, Rowland J. Clark, L. L. Warren, James M. Doty, W. Reeder, L. F. Marnett, R. W. Mitchell, Oscar Skovholt, E. L. Von Eschen

National Check Sample Service
Lester H. Fischer, *Chairman;* F. R. Earle, Howard C. Becker, D. K. Dubois, J. B. Morgenson, James M. Doty

Sanitation Methods
Kenton L. Harris, *Chairman;* Harold J. Goossens, Ross Cory, Harvie Barnard, Donald B. Davis, Robert Kilborn, Kenneth Rohrbough, D. K. Dubois

Soybean Products
L. B. Brown, *Chairman;* M. W. Dippold, Kenneth Holt, Charles K. Schenck

Prepared Baking Mixes Analysis
W. F. Schroeder, *Chairman*
Subcommittees:
Determination of Plasticity of Fats and Emulsifiers: Donald C. Meek, *Chairman;* Frank R. Schwain, Robert L. Dowdle, Oswald A. Oudal, Joseph Radov
Determination of Hydrolytic Rancidity: Edward I. Feigon, *Chairman;* Donald C. Meek, John B. Woenfel, L. F. Jents, Robert L. Dowdle
Evaluation of Emulsifiers: Joseph Radov, *Chairman;* Lloyd B. Crossland, Edward I. Feigon, Ira A. MacDonald, Paul E. Ramstad, C. W. Ofelt, Robert L. Dowdle
Yeast-Raised Products: David E. Downs, *Chairman*
Rate of Hydration of Powdered Milk: C. W. Ofelt, *Chairman;* Donald C. Meek, Jerome Van Beren, S. M. Duoos, C. M. O'Malley, Carl F. Obenauf, Joseph V. Reger, W. F. Schroeder
Rate of Reaction of Leavening Agents: Richard D. Haynes, *Chairman;* Donald C. Meek, James W. Tucker, Herbert I. Barnes

Test Baking Standardization
L. D. Longshore, *Chairman;* Frank Wichser, Jacob Freilich, W. H. Zenike, G. Moen, Henry Solle, John E. Lawler, Elwood C. Edelmann, R. L. Dowdle, H. T. Spannuth

Sedimentation Test
A. J. Pinckney, *Chairman;* D. C. Abbott, Frank B. Agasie, Marvin E. Armour, Howard C. Becker, D. K. Dubois, W. J. Eva, J. W. Giertz, W. L. Heald, Arthur J. King, James L. Lamkin, Edward Liebe, Gene W. Lenser, L. F. Marnett, Claude D. Neill, Paul D. Ochs, L. E. Schonlau, H. H. Schopmeyer, H. E. Smurr, Tod J. Stewart, Martin Wise, Mary V. Zaehringer

Soft Wheat Experimental Milling
E. F. Seeborg, *Chairman;* H. R. Fisher, T. F. Hartsing, H. K. Heizer, Fred Sipes

Vitamin and Mineral Analysis
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P.S. Just before press time I was informed of several items that I thought would be of interest to you, thus this additional note.

Dr. E. J. Bass, Chairman of the Canadian Prairie Section, has written that his group voted to subscribe to CEREAL SCIENCE TODAY for all non-national members. The section will pay for the subscriptions by increasing the dues of *all* members by 50c.

Thus another section has taken action that will help CEREAL SCIENCE TODAY be of even more benefit to cereal chemists and technicians everywhere. It's interesting to note that their method of handling the financial details varied somewhat from the action taken by the Midwest Section. It has also been reported that the Northwest Section has appointed a committee to study the question and that the committee will report its findings to the section on October 25.

Another matter that was just brought to my attention also concerns CEREAL SCIENCE TODAY. As you know an Advertising Committee was formed a few months ago to help our advertising manager explain to potential advertisers the advantages of directing sales messages to the chemist. The Committee discovered that our business office was unable to provide the advertiser with basic information concerning the activities of our members and they recommended that steps be taken immediately to rectify this situation. As a result a questionnaire will be mailed to all members during the next two weeks. It takes but *two minutes* of your time to answer, but it is most vital to the financial health of the Association.

W. B. BRADLEY



BOOK reviews

Sterilization in Food Technology, by B. G. Olin Ball, Department of Food Technology, Rutgers University; and F. C. W. Olson, Associate Professor of Oceanography, Florida State University; 653 pp., illus. McGraw-Hill, New York, 1957. Price, $16.00.

This new book explains the theory of the destruction of organic cells by lethal energy, shows the development of mathematical methods for predicting such destruction, illustrates the use of these methods, and describes present practice in the commercial use of sterilizing processes applied to canned foods.

The authors set forth the results of their more than 20 years' work on the engineering aspects of high-temperature sterilization and the mathematics involved in thermal processing. The method of predicting the lethal effects of the sterilizing process, evolved by Dr. Ball and here set down in detail, has served as the standard for the canned foods industry in all countries for more than 25 years.

Intended as a comprehensive manual of the entire field of food preservation, the book describes in detail all factors involved. These include the resistance of bacteria, molds, and yeasts to heat; the mechanisms of heat transfer in food and in food containers; and the combination of these factors into a theory for predicting conditions under which sterilization can be accomplished.

The book shows how the general method is also adaptable for predicting the destruction of desirable elements such as vitamins and organoleptic quality factors.

Biscuit and Cracker Production, A Manual on the Technology and Practice of Biscuit, Cracker and Cookie Manufacture, Including Formulas, by Ralph M. Bohn, xv + 278 pp. American Trade Pub. Co., New York and Chicago, 1957. Price $15.00. Reviewed by OTTO G. JENSEN, National Biscuit Co.

This book is highly recommended to technologists and production personnel in the biscuit and cracker industry. It contains a wealth of practical and useful information. Essentially, the text is based on material published by the author in *The Biscuit and Cracker Baker* over a period of several years.

The subject matter is well organized and is, with a few exceptions, presented clearly and concisely. The author states in the preface: "In this book an attempt has been made to combine what little science exists with practical production problems. Where possible, theories have been concocted, with the idea that any reasonably tenable theory is of help in producing new products, improving old ones, and trouble-shooting."

The eleven chapters cover all of the topics which one would expect to find in a book on biscuit and cracker production. The material includes discussions of the basic chemistry of biscuit and cracker materials and processes, raw materials, machinery and equipment, bakeshop formulas, packaging, food regulations, tests on raw materials and baked products, and sanitation and labor relations. The last chapter contains several tables and specimen sheets of production and cost data.

The first chapter is superficial and begins with an erroneous definition of pH. Mistakes of this type are unfortunate, but this reviewer would hasten to add that inaccuracies of this kind have no important bearing on the over-all merit of the book. Although the book is addressed to production men, we would suggest that those engaged in research and development in this area of cereal science will find the book a useful source of ideas. This reviewer encountered many notations which were of immediate signifiance to his own research problems.

■ ■ ■ ■ ■ ■

Yeast — Its Characteristics, Growth, and Function in Baked Products, edited by Charles S. McWilliams and Martin S. Peterson. 120 pp. National Research Council, Washington, D. C. Reviewed by J. W. LEE, University of Minnesota.

This paper-bound booklet contains reports on eight papers read at a symposium held in Chicago, Illinois, on June 22, 1955, and sponsored jointly by the Committee on Food of the Advisory Board on Quartermaster Research and Development and the Quartermaster Food and Container Institute for the Armed Forces.

The titles of the papers delivered at this symposium were:

"History of the development of active dry yeast," by Charles N. Frey; "Genetic principles as tools for the taxonomic study of yeasts," by Lynferd J. Wickerham; "Conditioning yeasts for the production of enzymes," by S. Spiegelman; "Effects of yeast on bread flavor," by John C. Baker; "Evaluation of the bread-baking properties of various genera and species of yeasts," by J. H. Mitchell, Jr.; "Theoretical and practical aspects of brew fermentation," by John Maselli; "Relationship of yeast fermentation, ingredients, and bread processing methods upon finished bread quality," by George F. Garnatz; and "Role of active dry yeast in commercial bread manufacture," by Paul P. Merritt.

The latter part of the booklet contains a full report of the general discussion on all the papers presented at the symposium.

This short publication contains much up-to-date information on yeast technology presented by some of the best authorities in the field.

Scientific French, by William N. Locke, 112 pp., and **Scientific German,** by George E. Condoyannis, 164 pp. John Wiley & Sons, New York, N. Y., 1957. Price, $2.25 and $2.50 respectively. Reviewed by R. J. TARLETON, **This Journal.**

These two books offer the cereal chemist a quick, practical approach for obtaining a reading knowledge of French or German. They are not the usual elementary language text, but represent a fresh, special approach for the scientist. Both books are designed for use with a technical dictionary and start the reader out almost immediately with *unsimplified* passages taken from scientific material. Grammar is introduced gradually and kept to the fundamentals. Construction and idioms which are literary or poetic have been excluded. The emphasis of both books is on teaching the reader to recognize and thus translate the forms that occur. No attempt is made to have the reader reproduce these forms for use in speaking or writing.

For one who must learn to read technical French or German and cares for nothing else, these two books plus a good dictionary will be all that's required. They are to be recommended also for those chemists who need merely a refresher.

■ ■ ■ ■ ■ ■ ■

Medical Manual of Chemical Warfare, 4th ed. (86 pp.) Chemical Pub. Co., Inc., New York, N. Y., 1956. $4.00. Prepared by a committee of British authors. Includes a chapter on nerve gases.

Chemistry of the Covalent Bond. L. B. CLAPP. (698 pp.) W. H. Freeman & Co., San Francisco, Calif., 1957. $7.50. A text prepared for the first-year chemistry course at Brown University.

Bacterial Fermentations (95 pp.; Wiley, New York, 1957; $3.00), the first of a series entitled "CIBA Lectures in Microbial Biochemistry," is based on lectures delivered by H. A. Barker at Rutgers Institute of Microbiology last year. Three different types of fermentations are included under individual headings: biological formation of methane; chemistry of butyric acid-butanol fermentations; and fermentations of nitrogenous compounds. Main emphasis is on the chemistry of energy-yielding processes, but in the discussion of methane fermentation considerable attention is given to more strictly biological matters such as isolation, nutrition, and classification of bacteria.

CEREAL LABORATORY METHODS

6th Edition

Any discussion of this world renowned book has to be directed to two separate groups — those unfamiliar with earlier editions and those who regularly use this volume in their laboratory as a standard methods source.

To the former group it should be pointed out that CEREAL LABORATORY METHODS has been published since 1922. It represents the work of cereal chemists employed in industrial, academic, and government laboratories throughout the world. It contains the accepted analytical methods used by these chemists for determinations on cereal or cereal by-products.

The 6th edition is 40% larger than the 1947 volume and over 50% of it is new and/or revised material. The most significant change is in style of presentation. The new 6th edition is divided into 100 categories consisting of "determinations" — determination of acids, of amylase activity, calcium, moisture, fat, etc. Each of these categories is further divided into specific tests.

Among the new methods included in the 6th edition are methods for testing prepared mix ingredients, physical properties of doughs, bread staling, etc.

The 6th edition has been designed for easy use by both the chemist and technician. Details are provided for preparation and standardization of all solutions. Apparatus are clearly described. Two separate indices are designed to provide quick access to any method in the book.

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Observations



The writer has had an opportunity now to work with 100% new southwestern bakers flour in several different bakeries and finds this year's crop has exceptionally good performance. In spite of the shorter farinograph mixing peak time, the flours show as much mixing tolerance as they did last year. Flour absorption is not as much lower than last year as we originally thought, and in actual bake shop practice we are only losing about 1% absorption. The doughs come out of the mixer softer and require more floor time but go through make-up exceptionally well, producing excellent grain and texture with very satisfactory loaf volumes.

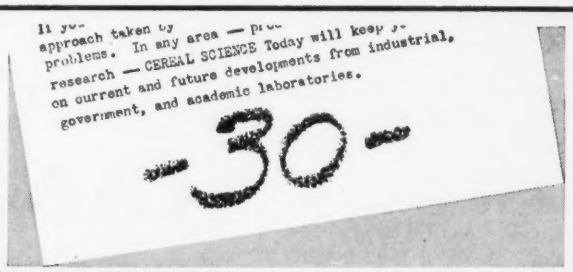
Mills which do not have their own bakery service organizations have used our services during the past years to go into bakeries to determine the cause of flour complaints. We bring this to the attention of the flour mill chemists to let them know that Doty Laboratories stand ready to serve the milling industry in bakery service work. We also stand ready to serve the cereal industry in all phases of analytical service, and we will do everything possible to continue our practice of accurate, rapid, and economical service.

The new National Check Sample Service series will be under way by the time this is published. We would like to bring it to the attention of all collaborators that the first samples this year will be a little late and the results will be a little hurried. However after the first month we hope that all future samples will have ample time for proper laboratory processing. We hope you will bear with us on this first sample.

Jim Doty

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MILLING FEED ANALYSIS
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A. A. C. C. Annual Meetings

Last July this column named the cities where future Association meetings will be held. The actual dates are now available and they are as follows: washington, D.C., May 3-7, 1959; Chicago, May 1-5, 1960; Dallas, April 9-13, 1961. The date for next year's meeting is April 7-11 in Cincinnati.

The Board of Directors is now ready to receive invitations from local sections for meeting sites beyond 1961, since it is necessary to plan three to five years ahead so that the Association may be assured of adequate facilities at the desired time. It is hoped that those sections headquartered in major cities will give serious thought to this problem, for the present method of selecting a convention site depends upon local section cooperation.

The officers of the Association believe that the Annual Meeting provides A.A.C.C. members with an excellent opportunity to renew old friendships and make new acquaintances and that this personal contact is extremely valuable to the individaul and to his employer as well. Since not all members can attend every meeting, the desirability of rotating convention cities is apparent. The Board tries to schedule meetings in the major cities located within the principal areas of A.A.C.C. membership. This means that meetings are usually east of the Mississippi and no further south than St. Louis or Kansas City. Occasionally the Board will plan a meeting in Denver or Dallas or even the West Coast so that members in these areas will have the opportunity of attending without having to travel half way across the country. Of course, most meetings are held in the Middle West and East since the bulk of A.A.C.C. membership resides there. Therefore, sections located in or near such cities as Chicago, New York, Cincinnati, Minneapolis, and Kansas City should expect to have the responsibility of conducting a convention at more frequent intervals than others. Local sections should remember that a national convention held in their city does not mean just work and nothing else. It means that fellow chemists from all over the country will be coming to discuss mutual problems, and it also means that the younger members of the section get a chance to participate at a national level.

During the past two or three years the A.A.C.C. headquarters staff has been able to offer certain special services to the convention committee which relieves the committee of a number of routine chores. Thus, the job of putting on a national meeting isn't as onerous as it was once. Even more help is being planned for the future, so local sections should not hesitate to issue invitations for fear the work and responsibility will be too great.

While the Board of Directors can choose a convention site without a prior invitation from a local section, such action is unnecessary and undesirable. There are sections that would welcome the national meeting every two or three years, but this, too, would negate the real purpose of rotation. During the past 20 years or so, the A.A.C.C. has repeated convention locations about every eight to ten years. There are some cities with large A.A.C.C. membership where the period between visits has been as long as 16 years. It is hoped that all sections will check the dates when last an A.A.C.C. meeting was held in their area. If it was before 1952, then certainly it's your turn to extend an invitation. If your section would like to have the meeting in 1962 or 1963, you should send your invitation to Dr. J. W. Pence, our national secretary. The time for this action is now, so please bring it before your group soon.

R. J. T.

